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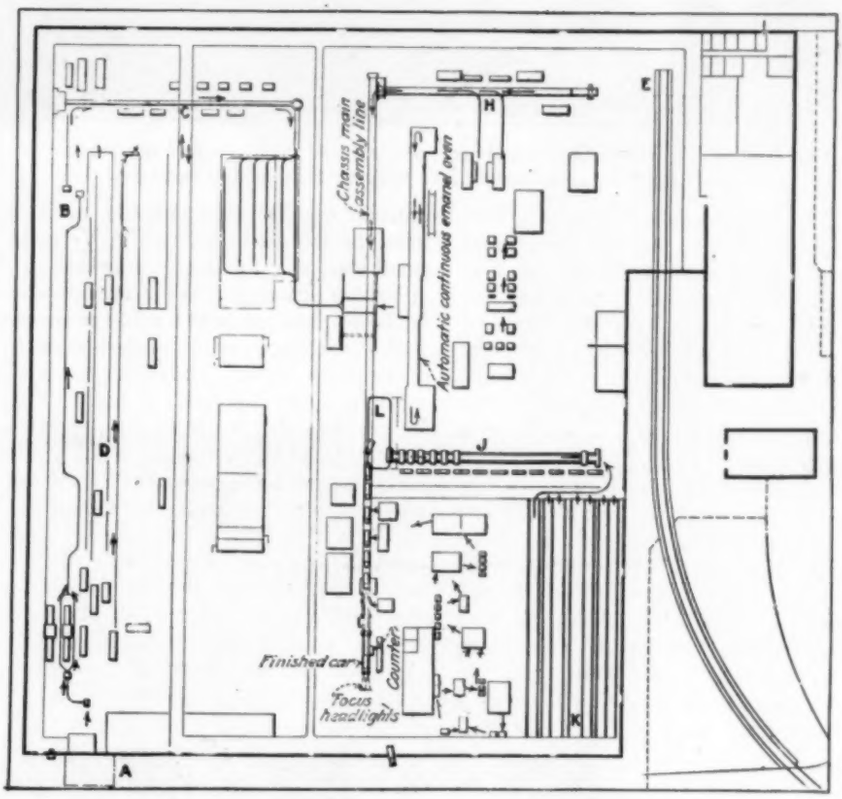


Fig. 1—Plan view of the way in which the Marmon plant has been laid out to handle 200 of the No. 68 cars per day

A study of the conveyor lines, the way in which the work flows, and how motors, frames and bodies come together, is of particular interest

Reducing Handling Costs

By Fred H. Colvin
Editor, American Machinist

AUTOMOBILE building involves the use of a great variety of materials. Handling these materials so as to insure a steady flow of the many parts to the final assembly line, and without having a large inventory awaiting assembly, requires a careful study of both layout and equipment. How well this problem has been handled in the new Marmon plant can be seen from Fig. 1, in which the layout and some of the details are shown.

Material enters the plant at three points. The combined cylinder blocks and crankcases come in at *A*, going into a normalizing oven kept at 900 deg. F., where they remain for 4 hr. From here they are sent to the sand, or shot, blast at the beginning of the conveyor line, and then pass on to the spray booth where they are given a coat of sealing paint on the inside, as in Fig. 2. Leaving the spray booth, the conveyor line is divided, as shown in Fig. 3, so as to supply the two large milling machines necessary for the first operation.

The path of the crankcase conveyor is shown with the break at *B*, Fig. 1, where the finished block is washed, sprayed on the outside and then passes to the motor assembly line, *C*. On the way down the line are the crank and camshaft boring operations, Fig. 4. This view is shown to give an idea of the distance between the conveyor and the boring machine, and also to show the short gap in the conveyor line to enable passage from one side to the other, without interfering with the use of the conveyor.

Paralleling the crankcase line are other conveyors as at *D*, Fig. 1, where connecting rods, bearing caps, flywheels and cylinder heads are machined. The piston conveyor

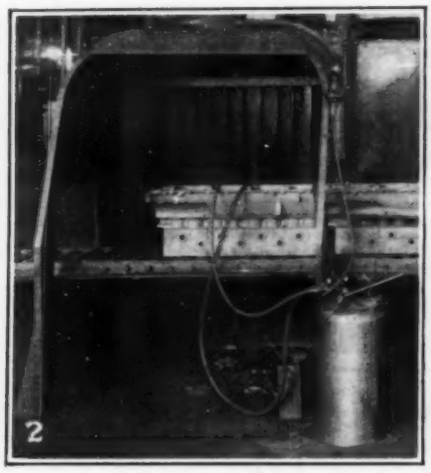


Fig. 2—Cylinder blocks and crankcases are painted inside to seal the pores
Fig. 3—Where the conveyor divides to serve two milling machines

line also is shown here. Along the motor assembly line, *C*, which is 200 ft. long and holds 40 motors, the various parts required to complete the motor are added. In Fig. 5 can be seen the manifold sub-assembly, with the fixtures used. Studs, washers, nuts, etc., are in convenient bins over the bench, and the assembly conveyor is right behind the workman. Fig. 6, shows how the power hoist handles the motor to the block-test department at the end of the motor assembly line in Fig. 7. The side arm brackets with wheels are in place in Fig. 6, but have been removed in Fig. 7. These brackets have guards outside of the wheels. Monorails serve every test stand, and all fuel and exhaust lines are beneath the floor. Each new motor is driven for 1½ hr. by another motor before running under its own power. It then drives a new motor for a like period.

In the meantime, the frames, springs and other purchased parts have been delivered into the plant at *E*, Fig. 1, from freight cars which run inside the building on a track that brings the car floor level with that of the shop. This track is 850 ft. long and holds 19 freight cars. The convenience of this arrangement is seen in Fig. 8, where springs are being placed directly on lifting-truck platforms on which they will remain until used, after, of course, being trucked to the proper place. The frames start down the frame assembly from *E*, Fig. 1, toward the center of the shop. The beginning of this assembly line is seen in Fig. 9, likewise the way in which the frames are stored and handled. A little farther down the line, the spare tire carriers have been applied. The frame line is 160 ft. long, holds 19 frames, and moves 12 in. per minute. Feeding into the line, at about the center, are the front and rear axle assemblies as at *H*, Fig. 1. At the end of the frame line, where it joins the pivot chassis assembly, is an automatic roll-over as can be seen at the left in Fig. 10. This device turns the chassis over onto its wheels on the flat-tread conveyor shown in the foreground. The conveyor is a somewhat unusual one for this purpose, as in nearly all assembly lines the wheels either run in V-tracks or are carried on small tracks or "dollies" connected to the conveyor chain at proper intervals. This type works out very well, as it allows the operator to ride the conveyor if necessary to follow a chassis, or to place his kit of nuts, washers or other parts, on it. The conveyor is 420 ft. long and has a 60 ft. pit at the end. It holds 28 cars and travels 35½ in. per min. for a production of 100 cars per day.

Alongside the chassis assembly line is an automatic, continuous-enameling oven. The oven is 195 ft. long and the work, such as fenders and dust deflectors, moves through it at the rate of 18 in. per min., being ready to meet the body line *J*, Fig. 1, when it leaves the oven. In the first portion of the oven the grease is burned from the fenders and other parts. The work then dips into a tank of enamel and is baked before it leaves the end.

While the motor is being machined, assembled and tested, the chassis is growing from parts that start at *E*,

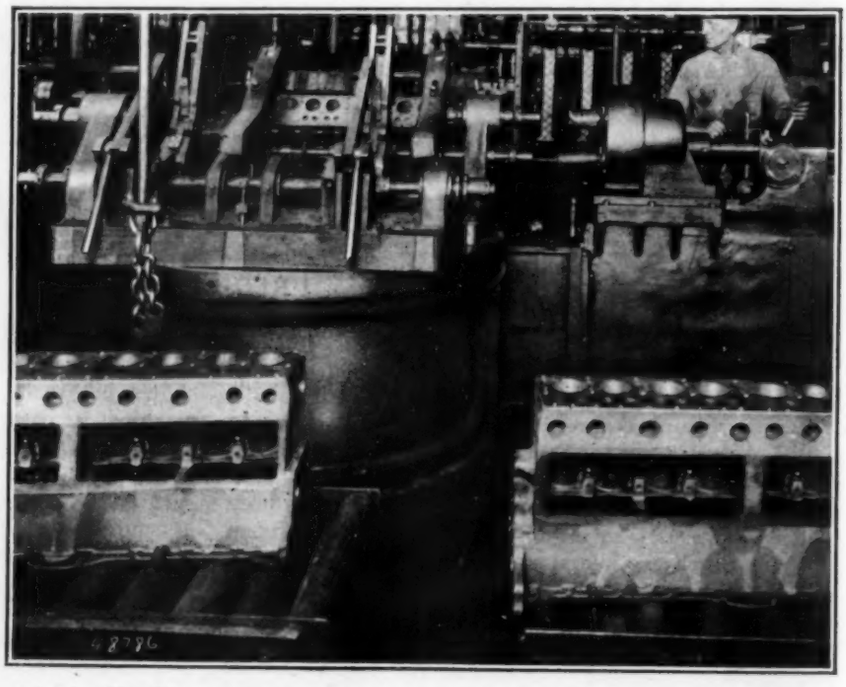


Fig. 4—One of the boring operations. This view also shows the proximity of the conveyor, and the short gap in the line to give access to the machines without interfering with the flow of material over the roller conveyor

Fig. 5—A sub-assembly bench beside the motor assembly line. The two fixtures aid in assembling the manifolds ready to be bolted to the cylinder block when it reaches the proper point of the line

Fig. 6 — End of motor assembly line, showing the roller brackets bolted to each end of the crankcase to support the motor on the rails. From here the motor is carried by a power hoist by a monorail to the motor block-test

Fig. 7 — A motor leaving the block test for assembly into the chassis. The roller brackets were removed before placing it in the test stand. This view also shows the type of test stand used. The motor under gas test drives a newly assembled motor for 1½ hr. as a run-in

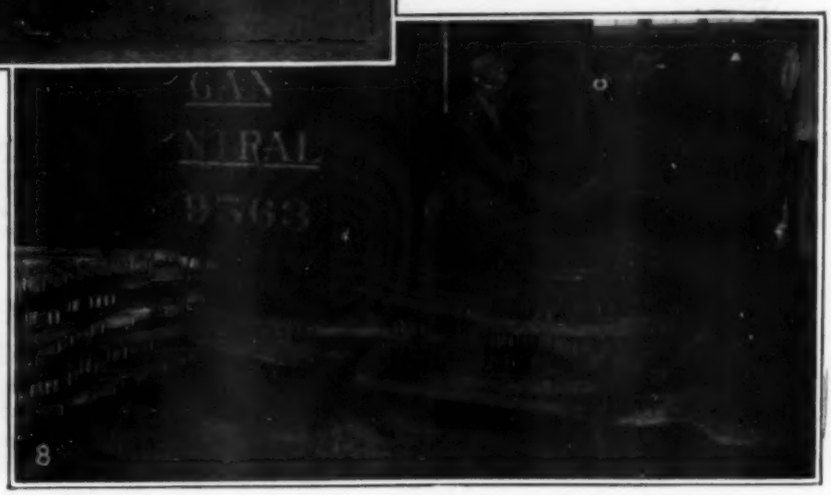


Fig. 8 — Receiving purchased parts from freight cars at the floor level. The parts are stored in small quarters near the assembly line, into which they feed as the chassis approaches completion. The truck platform saves much time and labor

Fig. 9—How frames are delivered to the beginning of the frame assembly line. The conveyor line is not far from the freight track where the frames are unloaded from the cars. This view also shows the storage of parts and how frame assembly proceeds

Fig. 10—The "roll-over" at the end of the frame line which is at right angles to the chassis assembly. This device automatically turns the chassis over on its wheels allowing it to start down the final line to receive engine, body, and other parts

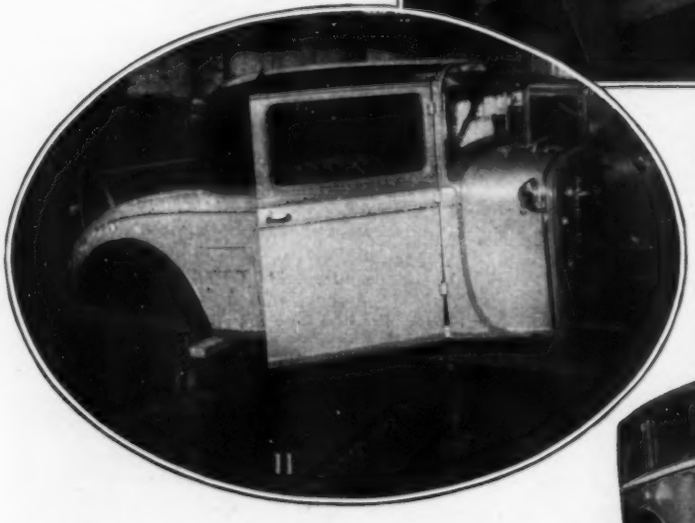


Fig. 11—Conveyor on which bodies are fitted up as they move toward the final assembly line. Cushions are stored conveniently beside the conveyor line to reduce the time required to secure them and put them in place

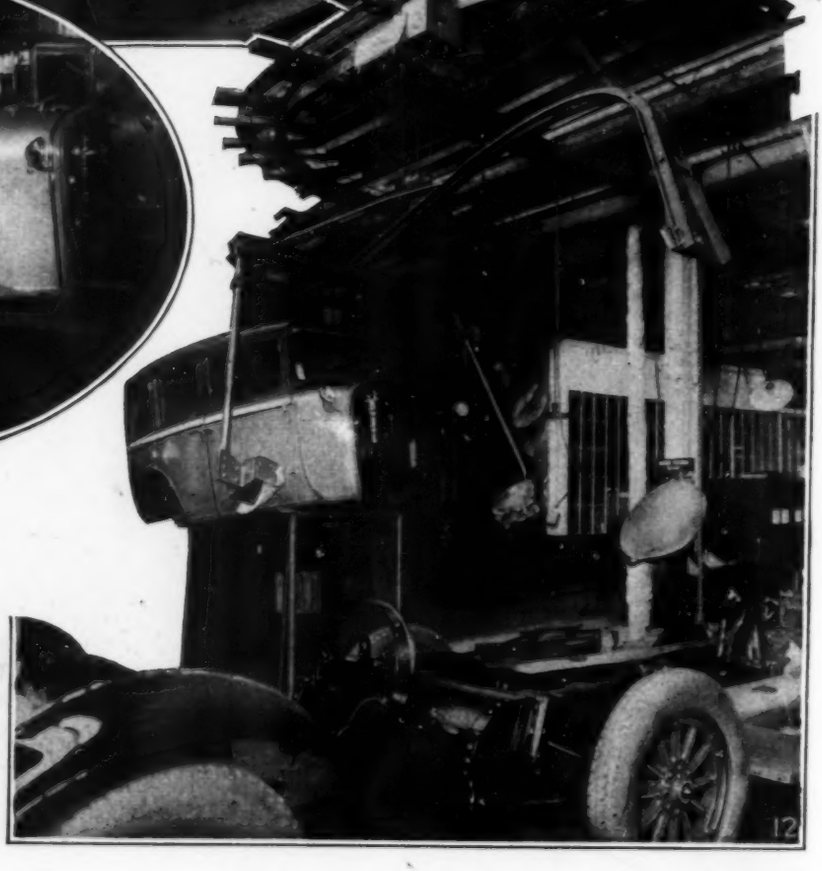


Fig. 12—Where the finished body meets the chassis. This shows the frame and clamp used in handling the body from its conveyor line, and, with the aid of a monorail, placing it on the chassis at this point

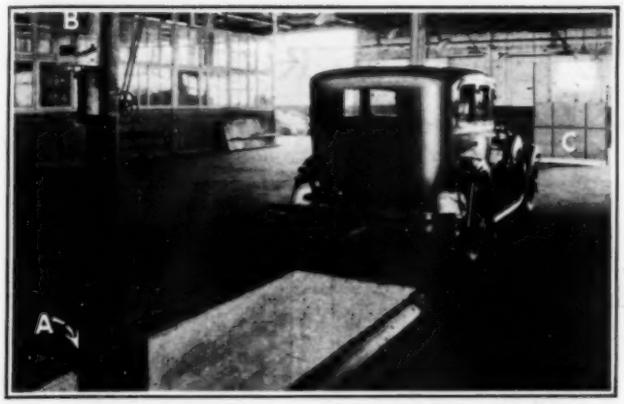


Fig. 13—The end of the assembly line, showing a finished car in position to have the headlights focused and adjusted on the screen in front. The car coming off of the line automatically tallies its number and lowers the focusing screen

the bodies being made ready for their final assembly to the chassis. Starting at the other corner of the plant, *K*, the bodies are fed out of storage to the cross conveyor, *J*, the body conveyor being shown in Fig. 11, where the bodies are "upfitted," as the operation is called. Here they are handled by a monorail crane as indicated in Fig. 1 at *L*. An end of the monorail is shown in Fig. 12 together with the lifting frame and clamps. The two side arms carry padded blocks that are swung under the rear fender housings by means of a right- and left-hand screw near the top, operated by the short hand chain at the right. The front end of the lifting frame hooks under the bottom of the dash. The body is shown resting on special supports provided for the purpose of temporary storage before lowering it to the chassis.

After the body has been lowered into place, the fenders are added and the car nears completion as it moves toward the end of the line. The various parts are added as indicated by the titles shown on the plan. Near the end of the line is a final test stand where the rear wheels rest on rollers and the motor is tuned up for idling, pick-up, speed and quietness. When the inspector is satisfied he drives the car off of the end of the line as in Fig. 13. Just before it reaches the end of the line it depresses the trigger *A*, which actuates a counter on the column at *B*, and so keeps tally on the number of cars that have come off of the line per hour, per day, or for any total desired. At the same time, the trigger releases the focussing screen, or target, *C*, which is also shown in Fig. 1, dropping it in place at the proper distance in front of the car. The headlights are then focussed on the screen and adjusted, after which the car is ready to drive to the shipping platform.

Machine-Lapping Steel and Cast Iron

By Ivan M. Tweedy

THE value of lapping has long been recognized for producing a wearing surface on steel and cast iron superior to that obtainable by grinding. In effect, lapping produces the surface condition that normally is obtained when it has been "run in" for some time. Until recently lapping was a lengthy process depending upon the skill of the operator, and was too costly for adoption in manufacturing operations. Within the last few years, however, machines have been put on the market which make possible the lapping of any plain cylindrical, tapered or small flat component, at a cost which is commercially sound.

Grinding cannot produce the glass-like finish gained in lapping, no matter how fine the abrasive. The surface of a component ground with a very fine abrasive is found to be a mass of furrows, slightly undulating instead of being truly cylindrical, although too small to be measured by ordinary shop methods. If this surface is now lapped to the "critical point," the component has a smooth, glass-like surface, with very much finer furrows, and is truly cylindrical. If lapping is continued past the critical point, peeling results, and the cylindrical effect is lost.

From this it is clear that lapping and grinding are entirely different, grinding being a process of metal removal by abrasion, and lapping a process that alters the molecular structure of the surface of the metal, maktng it less porous and therefore harder. Since lapping is a process in which the metal is compressed, worked, and the surface texture made finer, inaccuracies in the preliminary grinding cannot be corrected.

The reduction in thickness or diameter that occurs during the lapping process varies with the material of the component, and is a fixed amount for any given material. The lapping time also varies with the abrasive used, washed emery in kerosene being most common. In the case of materials of a less degree of surface hardness, such as chromium steel and cast iron, a less free-cutting abrasive is used.

The material of the component also influences the "critical point." With cast iron and case-hardened steel the critical point may be appreciably passed before the surface is spoiled, while with chromium steel, peeling starts almost immediately after the critical point is passed.

In general, the most easily lapped material is case-hardened steel, while softer materials are more subject to charging and must be lapped with less free-cutting abrasives. The ductility of chromium steel necessitates the use of fine, slow-cutting abrasives.

The lap faces must themselves be lapped until they are true plane surfaces, and laps so faced must be thoroughly cleaned so as not to spoil the surface of the component. After the roughing operation, laps should be cleaned before the finishing operation is made. Components should not have any crust on their surfaces, as such crust would be peeled off and become mixed with the emery in the kerosene, which would interfere with the lapping. The danger of spoiling the finish of the work warrants the utmost care being taken that the whole machine, with work-holder, is free from emery before the finishing operation is started. It is very difficult to thoroughly cleanse the machine.

Success in machine-lapping depends not only upon the machine, but also upon many factors such as preparation of the components, suitability of the material to lapping, and selection of the abrasive. However, the actual operation is simple, and with the appropriate abrasive and correct lapping time, work can be lapped at very small cost.

Selecting Shop Executives

WALTER MILFORD, of the Milford Corn Sheller Company, has been thinking a lot about picking shop executives. So he maneuvered an introduction to Bill Holland one day at the club and asked a question.

"Is there any sure-fire way to pick shop executives, Mr. Holland?"

"Not that I know of, Mr. Milford. I've seen so many different kinds of men in successful charge of shop work who didn't seem to follow any rule, that I've quit thinking about many rules."

"What about this psychology stuff? Do you take any stock in that?"

"Yes, indeed—some. But I wouldn't bank on it a hundred per cent, Mr. Milford. Why? Just because there are so many variables in human nature. As one of several things to judge by I'd listen to the 'psycho' man. But I'd want to know if the prospective executive had indigestion or a nagging wife, just as much as I would the shape of his ears, or his forehead."

"Just why the digestion, Mr. Holland?"

"Because I don't know anything that will warp a man's judgment more than a bad tummy. He won't mean to be unfair, but he just can't help getting a biased slant on things when he's feeling mean inside."

"And what about experience, Mr. Holland? Shouldn't a man have had training in the particular line you want him for?"

"That's the usual notion, Mr. Milford, but I doubt if it's always necessary—or always desirable. Steering any kind of work is so largely a matter of good common sense, regardless of the kind of work, that actual experience in that work may not be as important as it seems.

"It's Henry Ford's theory that you get better results if you don't know too many details of the way a job has been done before—and he's proved it pretty well in his glass making plants, and in other places.

"Of course experience has its advantages, but it often prevents trying out things that may have failed once but that work under new conditions."

"But you wouldn't pick a drygoods man for shop superintendent would you?"

"Probably not—and yet it has worked out. One of the best railroad master mechanics I knew had been a clerk. Got his job by marrying the super's daughter. But he knew how to handle men—and they all rooted for him after they got over being peeved about it. He gave every man full credit for what he did—never pretended to know anything about mechanical details—and the men did their level best for him."

"I've been thinking of taking a service man in off the road for general foreman of the machine shop. What about it?"

"Being on the road must have taught him where to look for weak spots in the machine. He can watch these points—and tell the men why they must pay particular attention to certain details."

"And I had this man examined by a psychoanalyst, and he O.K.'d him, Mr. Holland."

"So much the better. I wouldn't hold it against him. But I'd hate to depend on being 'psyched' if I needed a job very badly."

Executives are invited to discuss the problem involved in the foregoing case. Accepted contributions will be paid for.

Discussion

Training Men for Different Jobs

To provide training for the worker is distinctly a good business investment. It is neither sentiment nor philanthropy, and properly handled it produces big results. Its purposes are to aid in developing the efficiency of the individual employee, to show him he can render better service to industry, and to stabilize his purpose that he may be properly placed and work uninter-

ruptedly toward his goal. Maladjustment is one of the most serious causes of labor turnover and industrial unrest. Proper training enables a man to fit himself, by the quickest and most efficient method, for the individual job which best suits his capabilities. It gives him a safe and sure foundation for growth, and it insures to the company that trains him the services of a more efficient and broad-minded employee.

Training is valuable both for the trained and the untrained worker. In the first instance, it broadens his vision, keeps him in touch with new methods, teaches him more effective ways of performing the same duties, and gives him added incentive by showing him what is being accomplished by others in his line of work. In the second case it enables a man to make good in the occupation which he has chosen, for it helps to adjust him if he is not fitted to his work. It often happens that labor turnover is due to the fact that many employees go on the job not only incompetent, but also not well advised concerning either it or their relations to the factory.

—Joseph Viggiano.

Discouraging Cancellations

Mr. Holland gives good advice if he means that Mr. Knowles shall add to the bill the full cost of the dies. With reference to the material, perhaps Mr. Knowles can hold it in stock for other purposes. If not, he can try to exchange this material for material needed in his shop for other orders, or failing in this he must sell the material in the market for the best price possible. On future orders Mr. Knowles should provide for such contingencies. This can be done by buying the material needed in two lots. In this way he could hold his own costs within limits, and cancellations could not hit him so hard.

—Franz Bermann.

Paying Express Charges on Replacements

While the practice of charging the purchaser for the expressage on replacement parts appears rather unfair on the part of the manufacturer, there is a certain amount of logic in back of it. The manufacturer is not in a position to investigate the circumstances surrounding the use or possible abuse of the machine by the purchaser. He regards the practice of charging expressage as a form of insurance against careless or unscrupulous purchasers. In the case of purchasers whose business relationships have been long and pleasant, he would probably like to assume the cost, but it is hard for him to draw the line, and so he makes the rule rigid—with considerable justification.

As an indication of the attitude of the manufacturer when there is no question of where the fault lies, I would cite an instance that recently came to my attention. A certain large dealer questioned the strength of the radiator bracing on a new automobile. The dealer had strengthening clips made, and installed them for the cost of manufacturing the clips. Later, when this was brought to the manufacturer's attention, the feature was incorporated on new production. Replacement parts were supplied, shipped, and installed gratis. Refunds were made to those who had paid the manufacturing costs of their installations. At no time was there any question of paying express charges. We should appreciate that in the end we are saving money when, on very rare occasions, we are asked to pay shipment charges. Otherwise, the price of every machine would have to be raised to cover the abuse that would arise if replacement parts were obtained too easily.

—C. F. Furey.

A manufacturer, when setting the sale price on his product, seldom figures in the express charges on replacements, as it is generally conceded that the consumer pays them as they occur. It does not seem fair, however, to the consumer who is unlucky enough to get a defective part to have to pay the extra cost. It would be better, from his standpoint, for the manufacturer to pay the express charges and add the extra cost to the price of the machine.

It really makes little difference to the manufacturer who pays express charges, since he must make a profit over and above all expenses, and the consumer pays anyway. If he doesn't pay direct, he pays in added cost of the machine. However, if the manufacturer adds the cost to the price of the product and his competitors do not do likewise, he is at a disadvantage in having to ask a higher price. The best solution for everybody concerned would be for all manufacturers to pay the shipping charges on replacements. This system would be fair to everybody.

—Wm. J. Owens.

Patronizing Home Industry

In order for a manufacturing concern to stay in business and pay dividends on the invested capital, it must be able to produce a product that the public wants, at a price the public is willing to pay, regardless of whether the factory is located in New York or California. This means that it will have to buy raw materials at the cheapest possible price, with quality, service, and business relations taken into consideration, whether the supplier is located next door to the plant, or a thousand miles away from it.

The nature of the product being manufactured, the distance the factory is from the raw material field, and the ability to get prompt shipments of raw material, are the paramount factors

that have to be considered in each case. The sentiment about buying locally sounds good at a luncheon, but the details which surround the satisfactory purchase often make it necessary to buy elsewhere.

However, I have found it more satisfactory to buy close to home when possible. In many cases I have found that even if the local supplier is a trifle higher than a competitor located some distance away, the consideration of prompt delivery, or the ability of the supplier to stand behind his product and replace defective material promptly, may more than offset the additional purchasing cost. In cases of this sort, the arguments of Brewster are sound. —C. L. ANDERSON.

Vacations—Singly or All at Once?

Nearly all the discussions on this question have made the assumption that one of the methods was best regardless of the nature of the industry. Few have mentioned what kind of an industry they were prescribing for. And yet no one would suggest that the employees of a railroad or telephone exchange take their vacations all at once, although some of the statements made are broad enough to include these. Among the advantages of taking vacations singly are the following:

Men often get an exaggerated opinion of their value to the company. They feel that their departure would be a serious loss. When a man comes back after a two weeks absence and finds that his work has gone along just as well as if he had been there, he realizes that his work is not as valuable as he thinks.

The vacation period is a good time to try out new methods. It is often difficult to get an operator to give a fair trial to a new method. It would offend one operator to have another man try to surpass him by a new method, but when he is on his vacation a new man must be placed on his job. The new man is free from prejudice and has an opportunity for trials that cannot be secured at any other time.

With many industries the summer is a dull season. By giving vacations as long as the employees like, we have never found it necessary to lay off men. Some have been given as long as three months. It would be impossible to shut down the plant as long as the average vacation taken by our men without causing dissatisfaction among the employees, and greater dissatisfaction among the customers on account of delayed deliveries. —A. W. FORBES.

Buying on Performance

Because of its obvious application, and the directness of its units of measurement, price is a very much over-rated index of value in buying. Service, consistent quality, delivery and making good on defective parts are all vitally important factors in placing an order. But, the greatest of all these in awarding a purchase contract is "delivered performance." When you buy a gallon of paint, that's not really what you buy—you buy deterioration protection and pleasing appearance—at so much per square foot per year. What advantage is a few cents a gallon if its useful life is short, if its coverage is small, or its application a matter of slow and painstaking labor? To measure these factors is not as difficult as it may seem at times. A few panels done by the regular painter under direct supervision, and subjected to weather exposure, will soon tell a story.

So it is with the drills in question. It's not how much they cost, but how much metal they will drill out in the sizes used from the material used, with the equipment used. The best drills for one kind of metal may not be the best for another. Such tests should be conducted directly in the shop by shop men under shop conditions. Avoiding laboratory conditions wherever possible is advisable. It is not how the drill function under ideal lubrication on laboratory presses, but how they work under actual operating conditions, which are generally far from ideal. The ability to withstand abuse is often a very important factor.

—BERNARD F. MCCORMACK.

Making Power or Buying It

The plant owner who is going to succeed must give full attention to the production of the article, and while he must keep his power costs down, he should not have to nurse his plant. I have outlined below a few advantages that may be gained by buying electric power supply from the nearest generating plant. It should, of course, be realized that much depends upon the location of the nearest station, and this should be one of the first points to be considered. These advantages are:

1. Valuable space once taken up by boilers, steam engines or steam-driven generators, all with their attendant auxiliaries can now be used for actual productive machinery.

2. Maintenance charges are reduced; no shutdowns for boiler scaling or retubing boiler, or feed pump breakdowns.

3. No chance of leakage of power, providing the conduits have been well made and meter records are kept.

4. Owing to evenness of torque, there will be less wear and tear on machinery and belts than when the steam engine was connected to the main line shaft.

5. Stoppages are simplified, and no power will have to be paid for during non-productive hours; also increased costs due to starting up are now nil.

6. Cost of power can be accurately forecast and determined.

If the owner decides to change over, which he will do if he thinks along the right lines, he will find that his capital outlay will be small compared with the saving he will eventually make.

—J. S. HUNT.

Equipment Makes Possible the Ford Model A

By Fay Leone Faurote, M.E.

Final Assembly

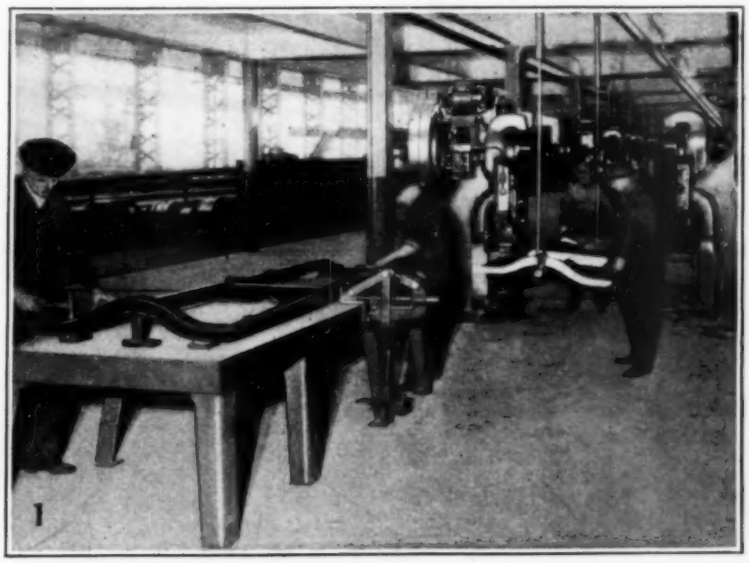
Some of the high spots in the assembly line that show how the various units are brought together and the way in which they grow into a complete car

FINAL assembly of automobiles is not only of interest to the observer, but it is also a test of the correctness of the design and of the machining operations that have gone before. Having studied the machine equipment, the operation sheets and the methods of producing the cylinder block, cylinder head, piston, piston pin, frame and other parts, and noted the close tolerances, we can see how the parts go together to make up the complete car. Beginning with the frame, as in Fig. 1, we see the assembly bench at the left and the frame starting down the line between the two rows of riveting machines. With the frame suspended from the track above, it passes to the various operations.

The actual chassis assembly begins after the motor leaves the motor line, as shown in Fig. 2, and joins the frame as in Fig. 3. Details of the way in which the motor is handled are seen in Fig. 4. In Fig. 5 the radiator and steering-gear assemblies have been put in place. Details of the four-wheel brake assembly are shown in Fig. 6, where the steering knuckle, the front-wheel roller bearing and the brake, enclosed by the hub, can be seen.

Wheels, already tired, and bumpers are added before reaching the point in the conveyor to be seen in Fig. 7, this view showing the brakes and their connections, as well as the method of attaching the bumperettes at the back. The bumper supports are cross braced, and they also reach over the rear cross-member of the frame and are fastened at the front end. Pads behind the cross-frame member are fastened to the underside of the body at the rear. This view also gives a good general idea of the appearance of the chassis before the body is mounted. The size and location of the motor, the large generator and the widespread triangular front brace, or "wishbone," are all shown in their actual proportions.

Rear and front quarter views, Figs. 8, 9, and 10, show cars practically completed and near the end of the line. Here bodies, spare wheels and lamps are all in place and the cars are nearly ready to be run off under their own power. In Fig. 9 the leading car is starting on the grooved runway that will raise it so as to be free from the conveying chain, ready to be driven off of the line. It will be noted that the line is provided with Cooper-



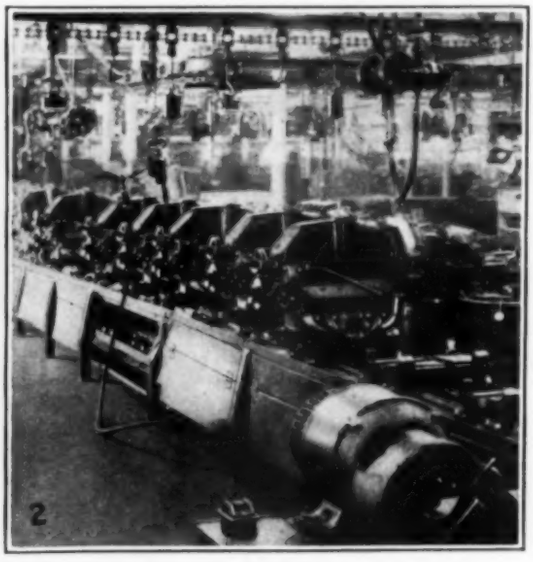


Fig. 1—Assembling the frames. The parts are located on the table at the left. The frames then go down the double line of riveting presses, suspended from, and moved by, the overhead conveyor from point to point. Fig. 2—End of the motor line. From here the motors are sent to the chassis or final assembly line. This view shows the type of trucks used to support the motors, the raised portions holding them in various positions

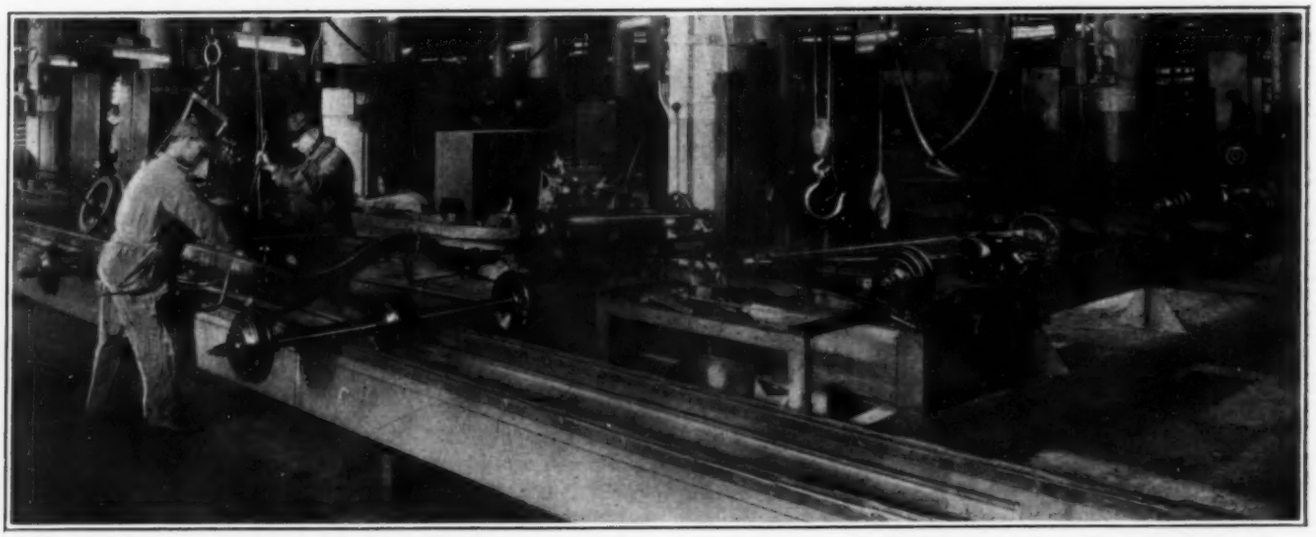


Fig. 3—Beginning the chassis assembly. The frames with rear axles in place are fed in from the right, and when the various units have been attached, they are rolled over onto the chassis line in the foreground

Hewitt, or mercury-vapor, lamps. How well these lamps light the assembly line at night can be seen from Fig. 10. This view also shows how touring cars, coupes, trucks and sedans follow each other on the line. A completed Tudor sedan is shown in Fig. 11, together with the standardized blocks for holding it against movement while in a box car.

Chassis Assembly Operation Sheet

No.	Operation	Machine	No. per Hour
1	Place frame assembly on stand. Assemble brake - equalizer operating-shaft and bushing Assembly in place with two equalizer operating-shaft-pin caps and two brake-operating shaft-pin caps, four bolts, four nuts and four cotter pins. Tighten nuts with electric drill. Use grease on all working joints	.....	...
2	Move assembly to next stand. Assemble two running boards to frame bracket (front), one right and left running board to frame bracket (rear) with twelve rivets Rivet, using bar and hammer to hold in place for press operation	.....	...
3	Place in machine and rivet twelve rivets, one rivet at a time	Southwark compressed air press 4-PA-4 Ferracutes	40 120
4	Place assembly on sliding stand, bottom side up. Assemble right- and left-hand brake cross-shaft assembly; brake equalizer beam with two brake cross-shaft frame brackets, two brake cross-shaft frame bracket shims, four bolts, nuts and cotter pins. Tighten nuts. Use grease on working joints	.....	...
5	Assemble two brake-rod springs to brake-rod spring bracket	.....	...

Chassis Assembly Operation Sheet (Continued)

No.	Operation	Machine	No. per Hour
5 (Continued)	with four bolts, nuts and lock washers. Tighten two bolts and two nuts, only		
6	Assemble two engine rear-support brackets to frame with two engine rear-support cushions (inner), six engine rear-support spacers, two engine rear-support cushions (outer), two engine rear-support plates, six bolts, nuts and cotter pins. Screw nuts on loosely	.....	...
7	Assemble two shock absorber assemblies; front right and rear left. Two shock absorber assemblies; front left and rear right. Attached with two arms, two arms to frame assembly with eight bolts, washers and nuts, and tighten. Set dial of shock absorber on No. 3 for front, No. 4 for rear. Frame bottom-side up on conveyor.		
8	Assemble two front - fender brackets in place, with two long bolts, short bolts, four nuts and four cotter pins.	.....	...
9	This operation done on special fixture before assembly to chassis. Assemble front-spring assembly to front axle, tie rod and radius rod assembly, with two front-spring hangers and front-spring bolts, four nuts and cotter pins. Press four lubricator fittings in place. Line front spindles to fixture, and tighten tie bolts and nuts of tie rod. Assemble two front-hub dust caps in place on spindle with hammer and punch. Tighten front-spring hanger bolts on stand, so front radius-rod is in air. Assemble drag link with two drag-link ball	.....	...

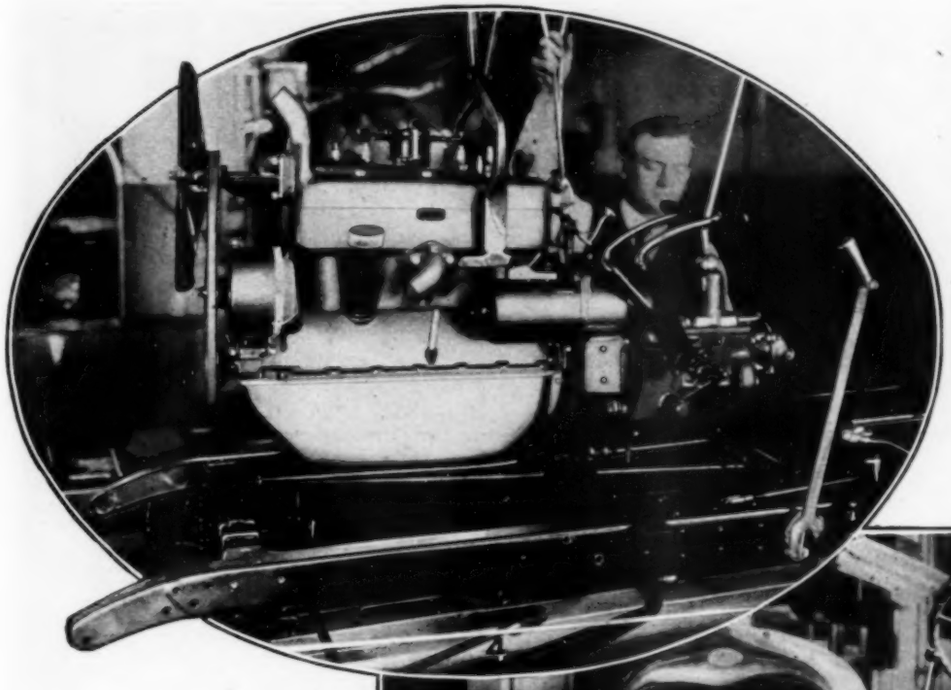


Fig. 4—Lowering the motor into position on the frame. The tongs grip the cylinder block so as to balance the combined weight of the motor and transmission. The unit is handled by a power hoist above the line

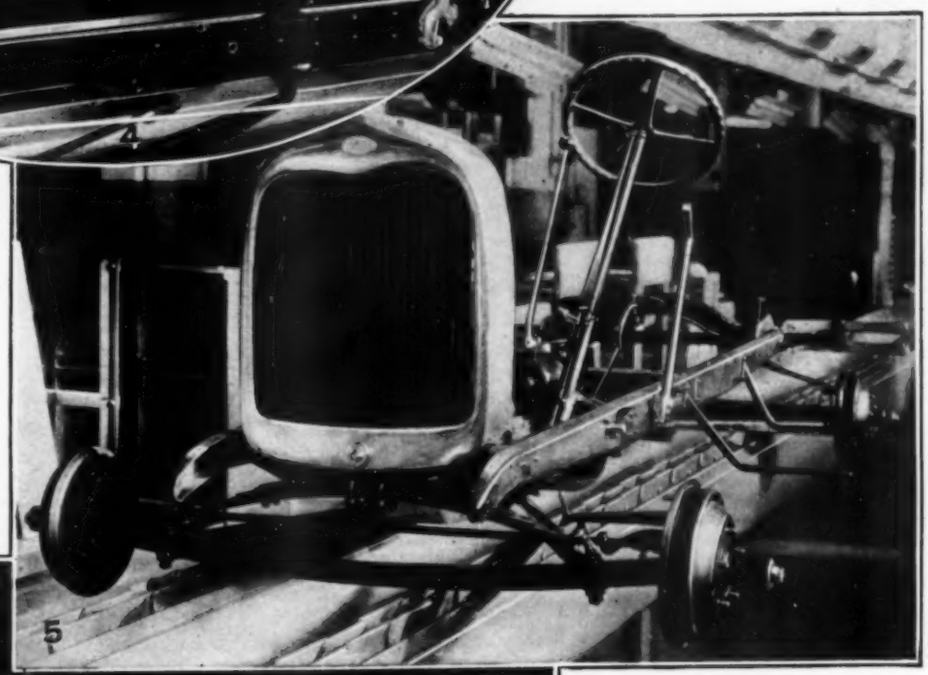


Fig. 5—Chassis with motor, radiator and steering gear in place. This view shows the front axle, the cross-springs, the triangular brace and the way in which the brakes are enclosed

Fig. 6—One of the front-wheel brakes ready to be put in place. The steering knuckle, the inner roller bearing for the wheel and the brake assembly that fits on the knuckle flange and is enclosed by the wheel hub, also can be seen

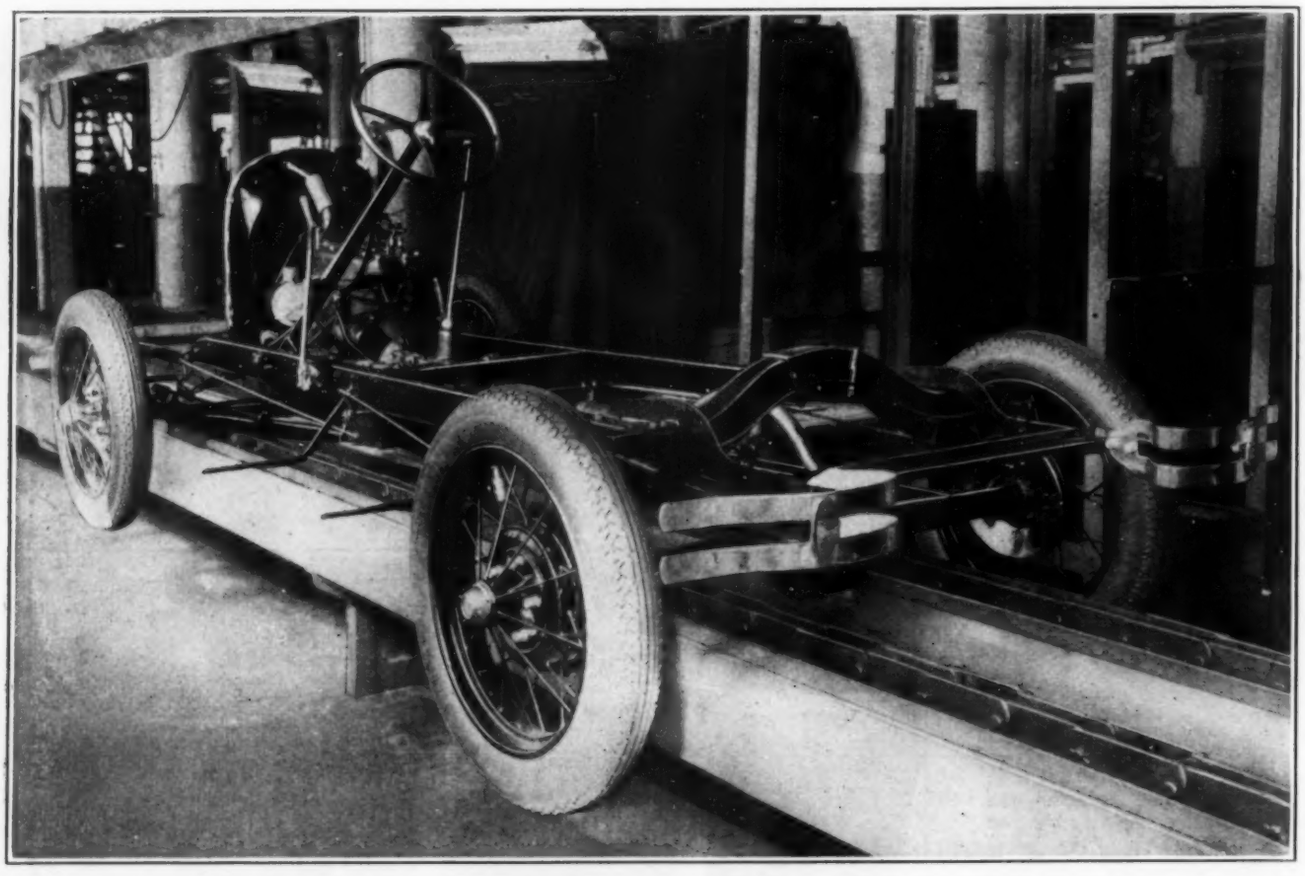


Fig. 7 — Farther down the line where the wheels are in place, the four-wheel brakes connected and bumpers in place, both front and rear. This view also shows how the rear bumpers are held and braced

Chassis Assembly Operation Sheet (Continued)

No.	Operation	Machine	No. per Hour
9 (Continued)	seats, plugs, springs, cotter pins, grease retainers and grease-retainer caps to steering gear arm, assemble to spindle arm and tighten. Use grease on all moving joints		
9½	Place assembly on sliding conveyor sidewise. Assemble front-axle assembly, front-spring assembly and drag link to front end of chassis with front-spring clip bar, two front-spring clips, one starting crank bearing, four nuts and cotter pins. Tighten nuts. Use grease before placing spring in front cross-member. Use conveyor to bring spring- and front-axle assembly to conveyor line. This operation to be done bottom-side up	.....	...
10	Assemble to rear end of frame, rear spring assembly with two rear-spring clips, rear-spring clip bars, four nuts and cotter pins, and tighten. Use grease before placing springs in rear cross-member. This operation to be done bottom-side up	.....	...
11	Assemble rear-axle assembly to spring frame assembly with	Fixture to hold spring in place	30

Chassis Assembly Operation Sheet (Continued)

No.	Operation	Machine	No. per Hour
11 (Continued)	two rear-spring hangers and rear-spring hanger bars, four nuts and cotter pins. Place four lubricator fittings in hangers. Frame bottom-side up on conveyor		
12	Connect universal housing-cap outer assembly to brake cross-shaft assembly, right- and left-hand, with two bolts, nuts and lock washers, and tighten. Use grease on torque tube bell. Frame bottom-side up on conveyor	.....	...
13	Hang on overhead conveyor, bottom-side up. Spray with black proxylin all over bottom side	.....	...
14	Remove from overhead conveyor and place on automatic rolling conveyor, sidewise. Spray with black proxylin all over top side	.....	...
15	Assemble two front-brake housing and brake-shoe assemblies to front axle with two pins, felt washers, grease-baffle assemblies, eight bolts, nuts and cotter pins. Tighten nuts. Place two front-wheel bearing-cone assemblies, two grease-	.....	...

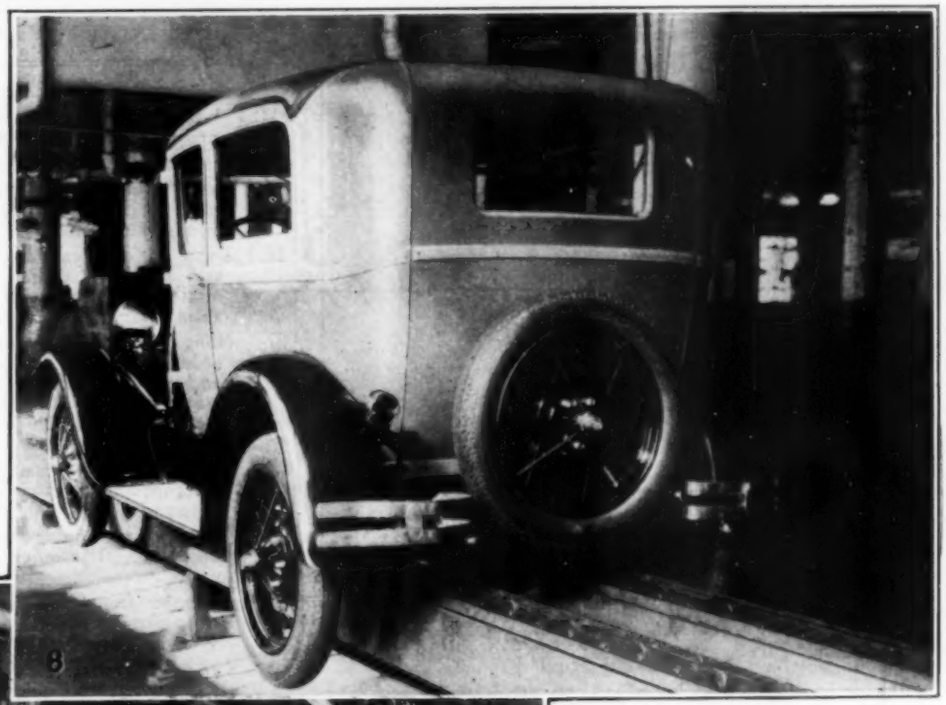


Fig. 8 — A Tudor body in place on the chassis, the fenders and running board in place, the spare wheel in position, and the front and rear lights mounted

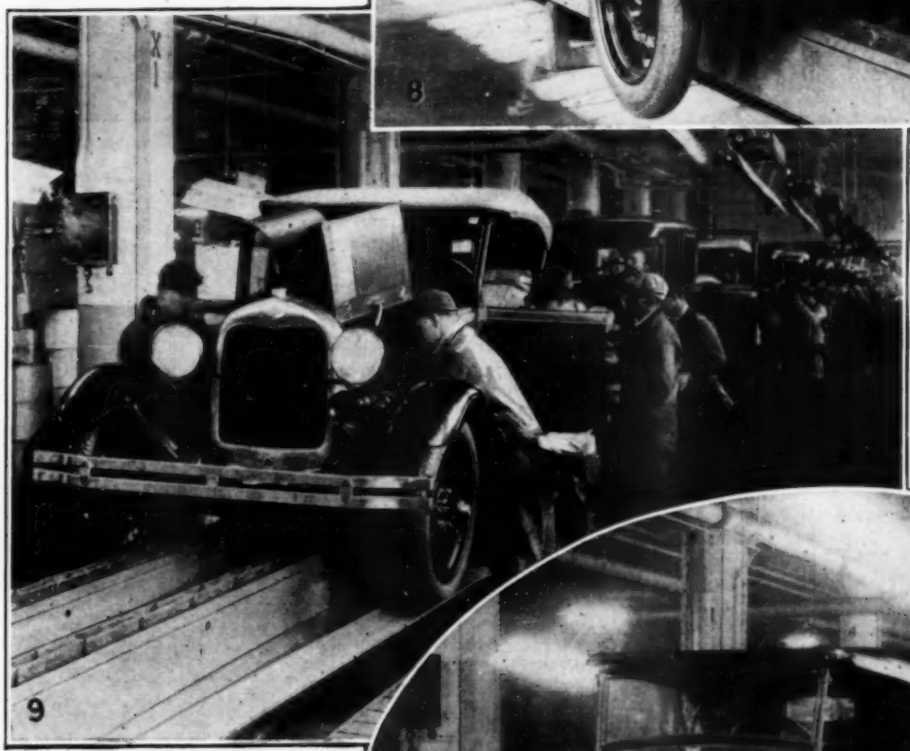


Fig. 10 — A similar view taken at night and showing the illumination from Cooper-Hewitt, mercury-vapor lamps. How touring cars, coupes, trucks and sedans follow each other on the assembly line can be seen

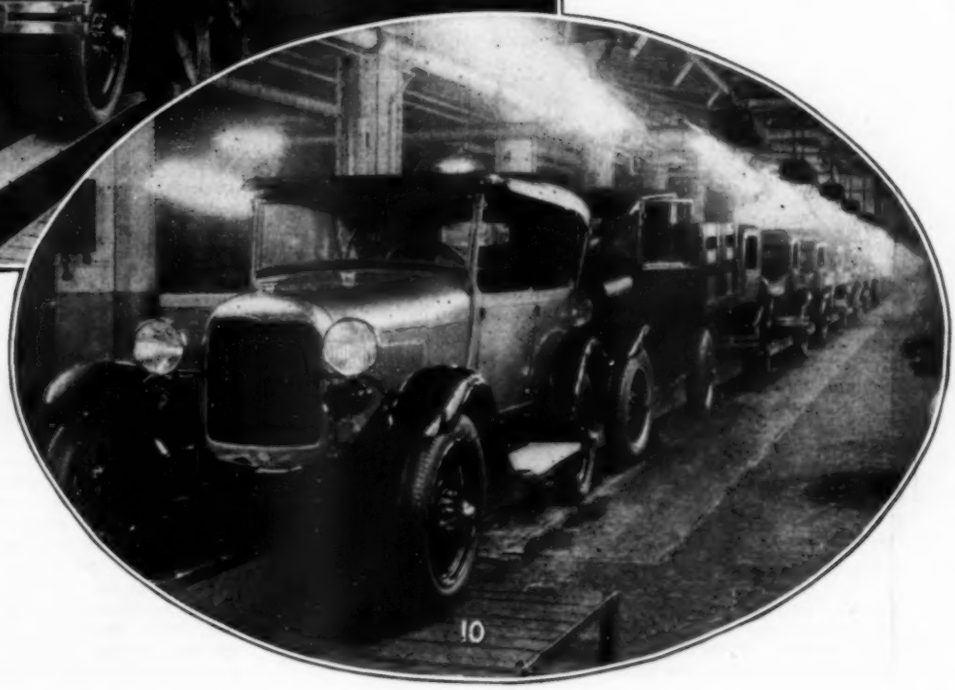


Fig. 9 — Nearing the end of the assembly line. Here the front car has reached the inclined wheel-runway that lifts it out of contact with the conveyor chain, and leaves it free to be run off under its own power

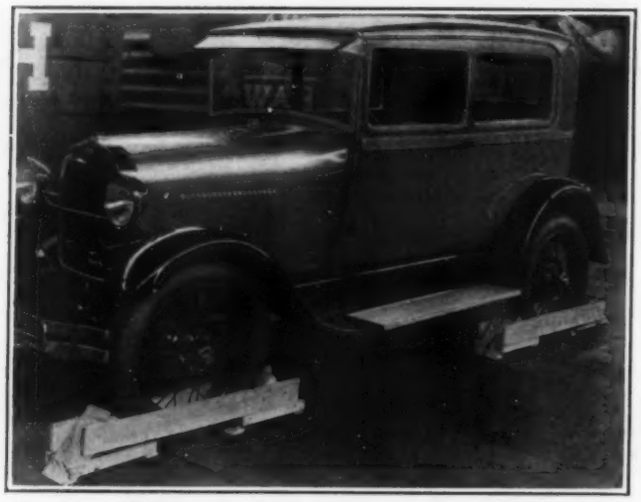


Fig. 11—Completed Tudor sedan ready for shipment in a box car. The standardized blocks used to hold the car against movement in transit are in place. Two blocks are used for each wheel. After they have been adjusted to the wheel they are connected by side boards and then nailed to the car floor

Chassis Assembly Operation Sheet (Continued)

No.	Operation	Machine	No. per Hour
15 (Continued)	retainer washers. Dope all front-end grease cups		
16	Assemble right- and left-hand engine pan to side members of frame assembly, only, with six bolts, nuts and cotter pins. Tighten with Yankee screw driver	.....	...
17	Clean spot on center cross-member with gasoline to assemble battery to ground-connector assembly with bolt, nut and lock washer, and tighten	.....	...
18	Assemble brake pedal equalizer-shaft rod assembly to left-hand brake cross-shaft assembly with cadmium pin and cotter pin	.....	...
19	Assemble right and left rear brake-shoe and housing assembly with two rear-brake grease - baffle assemblies. Tighten all nuts	.....	...
20	Fill rear axle differential with one quart rear axle oil	.....	...
21	Assemble two bearings, retainers and retainer rings. This operation to be done on hand arbor press before placing on assembly	Greenerd hand arbor press with lubricant. Air pressure tank combined	...
22	Remove axle nuts and assemble two rear-hub and brake-drum assemblies to rear axle	.....	...
23	Remove axle nuts, outer bearing and retainer washer. Assemble two front-hub and brake-drum assemblies, filled with grease, to front axle. Reassemble bearings and nuts	.....	...

Chassis Assembly Operation Sheet (Continued)

No.	Operation	Machine	No. per Hour
24	Inspection of chassis	Hand operation	...
25	Assemble clamp to hold torque-tube bell in place for assembly of engine assembly	.....	...
26	Hang on overhead conveyor, and place on sliding automatic conveyor, with both axles resting on conveyor	.....	...
27	Hang engine assembly on overhead conveyor, place in chassis and prop in place. Stamp motor number on left side-member near clutch pedal	.....	...
28	Assemble right and left engine pans to oil pan boss and front cross-member with two bolts, nuts and cotter pins	.....	...
29	Touch up with paint wherever necessary. Use quick-drying paint	.....	...
30	Assemble front radius-rod ball to engine clutch-housing with front radius rod ball cap, and two front radius rod ball cap bolt sleeves, springs, nuts, bolts, cotter pins and one retaining pin and retaining cotter pin. Tighten with hand socket-wrench	.....	...
31	Tighten front and rear axle-shaft nuts with four cotter pins in place	.....	...
32	Assemble four wheel and rubber tire assemblies to hub and brake-drum assembly with twenty nuts, and tighten. Use electric socket wrench. Use grease on bolt threads. Assemble four hub caps in place with punch and hammer	.....	...
33	Assemble four shock-absorber link tubes to shock-absorber assembly and connect with four filler plugs, lubricator fittings, cotter pins, spring spacers, grease retainers, grease retainer cups and plugs, and tighten	.....	...
34	Assemble four bracket bolts to engine with four nuts and washers, and tighten. Use socket wrench. Assemble two front cross-member bolts to engine with two nuts and washers, and tighten	.....	...
35	Tighten six nuts of engine rear-support bracket on frame, with six cotter pins. Use electric socket wrench	.....	...
36	Assembly of radiator before assembly to motor and frame assembly on line. Assemble radiator (less shell) with fan-housing assembly, two screws and nuts, one radiator-pipe assembly and hose connections, two hose connections and hose-clip assemblies, and four hose clip assemblies	.....	...
37	Assemble above assembly to engine and frame assembly on line, with two pads, bolts, springs, and cotter pins. Use gage to set radiator in place	.....	..

Chassis Assembly Operation Sheet (Continued)

No.	Operation	Machine	No. per Hour
38	Assemble front-bumper assembly to front end of frame with four bolts, nuts and washers, and tighten		
39	Assemble four cross shafts to axle brake clevises with two brake rod clevises, eight brake-rod clevis pins and cotter pins, two brake-rod spring cotter pins, bolts, nuts and washers, and tighten		
40	Assemble hand brake-lever bracket assembly to frame with hand brake-lever arm attached, four bolts, washers and one spring. Tighten		
41	Assembly of steering gear to wheel and wire assembly before assembling to frame. Assemble to steering gear housing and column assembly, Lighting switch assembly, wheel assembly and assembly of switch, with two conduits, one conduit for horn, two insulators, four terminals, four screws, spider, two springs, one horse-shoe spider retainer	On fixture for holding steering column in place and on bench, also	
42	Assemble above assembly (operation 41) to left side of frame assembly with two bolts and nuts. Tighten		
43	Assemble muffler assembly to engine exhaust and side frame with muffler-pipe bracket, bolt, nut, cotter pin, and tighten		
44	Assemble battery-support assembly to side and center member with four bolts and nuts, and tighten		
45	Assemble rear-bumper assembly to rear end of frame with four bolts, lock washers and nuts, and two bolts, nuts and washers, and tighten		
46	Grease all lubricator fittings with Alemite Air Line Lubrigun		
47	Fill radiator with water. Assemble radiator shell to radiator with one cap, four screws, washers and nuts		
48	Assemble battery (with cover in place) with two battery clamps, and nuts. Connect terminals in place		
49	Assembly of right and left fenders to right and left running board shields with two gimp strips, twenty-six washers, fourteen lock washers, fourteen bolts and nuts. This operation to be done on felt padded bench. Use overhead conveyor. Socket wrench		
50	Assemble above assembly (operation 49) to chassis with two cloth ribbon-strips		
51	Assemble running-board assemblies to fender shields and brackets with two strips of tape for shield edge, eight bolts, ten nuts and two lock washers, and tighten		

Chassis Assembly Operation Sheet (Continued)

No.	Operation	Machine	No. per Hour
52	Assemble two-head lamp assemblies with horn assembly in place, head-lamp support and tie-rod assembly		
53	Assembly of Tudor body assembly with rear fenders, right- and left-hand and wheel-carrier assembly, tail light and license-bracket assembly		
54	Hang above assembly on overhead conveyor. Place on chassis in place		
55	Assemble to chassis and engine assembly with eight bolts, eight lock washers, eight nuts, four blocks and rubber assemblies		
56	Assemble four bolts to rear bumper to frame, four lock washers, four nuts, tighten		
57	Assemble two blocks with rubber attached to running-board shield and frame		
58	Assemble two radiator rods to radiator and body with six nuts, two cup washers, four washers		
59	Assemble right- and left-hand shelf assembly to frame with eight screws, lock washers and nuts, and tighten		
59½	Assemble two hood-clip assemblies with two blocks, screws and nuts	Hand operation	
59¾	Assemble hood-clip bumper	Thompson riveter	200
60	Assemble front splash shield assembly, two pads attached to front end of frame		
60½	Assemble two felt pads in front of shield with two rivets	Thompson riveter	240
61	Assemble pipe assembly to sediment bulb, to carburetor assembly, and tighten nuts		
62	Assemble accelerator to steering-gear rod, accelerator to carburetor rod, spark control rod in place, coil to distributor-wire assembly		
63	Assemble all wires to horn, head lights, starter and generator		
64	Assemble rear wheel and tire assembly to rear end of body, with three lugs, and tighten		
65	Assemble carburetor adjusting-rod in place with spring, sleeve, collar, and two anti rattlers		
66	Assemble four license clips to head-lamp support rod with two bolts, lock washers and nuts		
67	Assemble to inside of body, four rubber covers, twenty-four tacks, two rubber pads		
68	Assemble hand brake-lever assembly in place		
69	Assemble hood assembly		
70	Start engine and run off of assembly conveyor		
71	Final inspection		

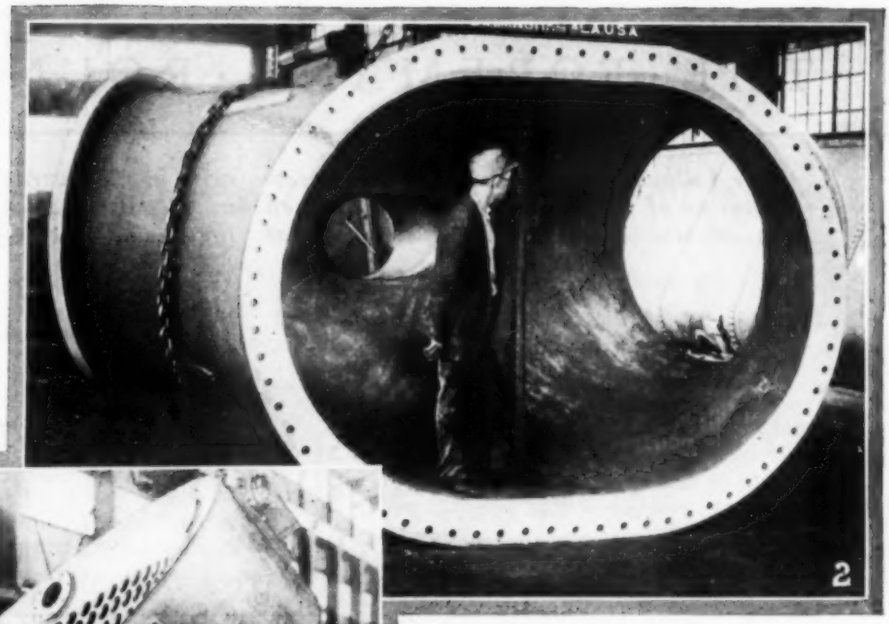
Building Heavy Machinery *in the South*

The position of Birmingham, Alabama, in the center of rich deposits of iron ore and extensive coal fields, and the fact that it has barge connection with an important southern shipping port, have combined to make it a center of heavy sugar machinery building. At the same time the huge chemical industry being developed from coal products is calling for machinery and large mechanical installations that are now frequently being built and repaired locally. Two large machine shops handling work of this nature have been shown in previous issues. A third plant is here illustrated, together with typical examples of work done.

The machine shop proper of the Joubert and Goslin Machine and Foundry Company, at Birmingham, illustrated in Fig. 1, is a brick and steel-frame structure 90x300 ft. Two 25-ton cranes serve the 60-ft. main bay. The chief work of the shop comprises evaporators and other apparatus for sugar mills and chemical plants, much of which is extra-large cast-iron or plate-steel frame work which must be machined and fitted to withstand high steam pressures. The work is seasonal, and in the sugar crushing months the shop operates a maximum force day and night, while during the slow months of the winter all machines and shop equipment are given a thorough overhauling. Sugar machinery destined for distant points, such as Brazil and the Far East, is completely set-up and marked in place before shipping. As the boiling equipment is generally of very large size this requires unusual assembling space. An assembly pit, 30 by 8 ft. and 10 ft. deep, is provided at one end of the machine shop, giving 38 ft. clear head room under the cranes. It is fitted with steam and other connections.

1

The discharge casting shown in Fig. 2 weighs 24,000 lb., with its larger face measuring 98x123 in. To machine the face, the casting was hung and strapped to the rail of a 20-ft. boring mill. A cutter was mounted in a special head on the table of the machine, so that the cutter revolved and the casting remained stationary. The feed was obtained by means of a screw and star wheel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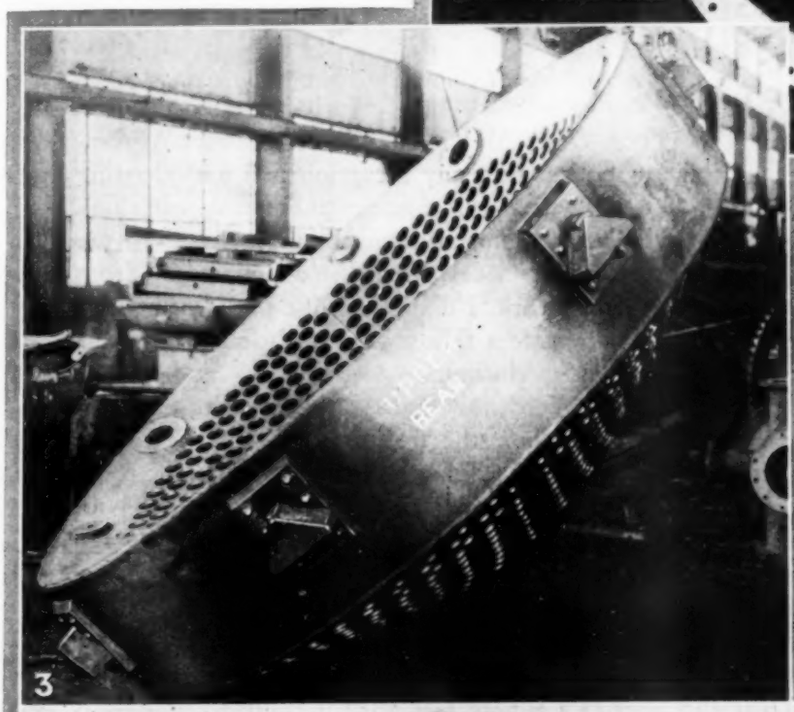
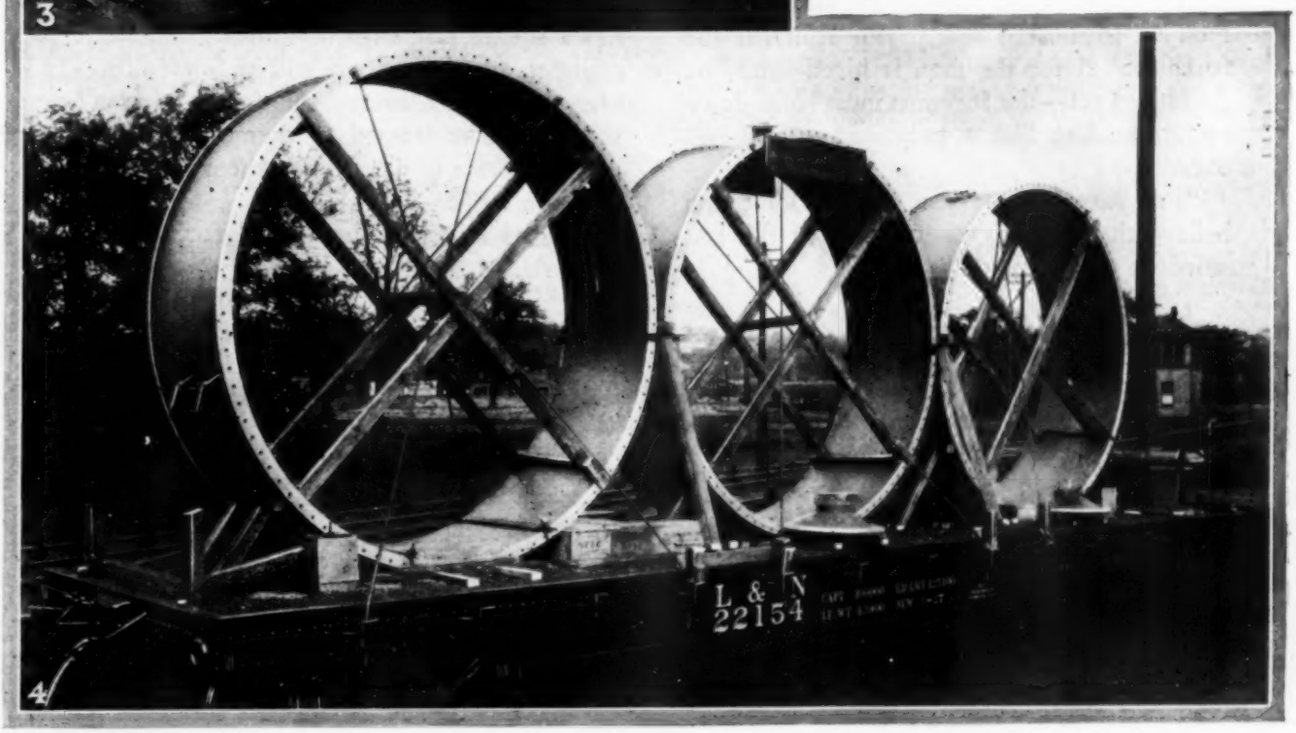

3

The 13-ft. "calandria" for a Cuban sugar mill, shown in Fig. 3 is built up ⅜-in. ingot-iron plate, and weighs, with internal piping, 20,000 lb. Each sheet is dished at a 30-deg. angle, and has 550 holes which must be in line and must be to a true vertical. The holes were drilled with a 3½-in. drill, using a cast-iron jig to guide the drill

Shipping is one of the biggest problems in heavy machine work, and casting sizes are often limited by the clearances of railroad tunnels. In some cases part of the floor of the car is removed, or the "gun-carriage" flat car is used. Exceedingly great care is employed in bracing large castings to withstand the jolting of the cars, as breakage of one piece may mean the loss of the work of a whole sugar season, as well as the cost of the piece itself. The filter body shells shown below are 8 ft. 8-in. diam., with casting thickness only 1 in.



4

· THE · FOREMAN'S · ROUND · TABLE ·

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

Hiring in the Open

"THAT'S a queer arrangement they have for hiring men over at the Taylor plant, Al," said Ed, during one of their evenings of 'talking shop.'

"Why, it looked good to me, Ed, the way Schmidt explained it to us. He says they cut out the old way of having the applicants stand in line and peek through a tiny window like going into a jail. Now they have a big room with tables where the fellows can come and fill out their application blanks and then sit down until it's their turn to be examined by the clerk. What's the matter with that, Ed?"

"Maybe that part is all right, Al, though I think it's a lot better to throw 'the fear of the Lord' into them right at the start. What I object to most is this parlor stuff for the foremen. After the man is hired—only he isn't hired yet—the foreman must come down and treat him like a lady and talk things over."

"I'm surprised at you, Ed. Don't you believe the foreman ought to have the last word on the hiring?"

"Yes, Al, but I don't like the idea of coming out into any reception hall and chatting with a fellow. Some of these birds will think they're going to have the parlor stuff all the time. Besides, when I'm all dirtied up from shop work, I don't feel like parading myself alongside a fellow who's all dolled up in his Sunday clothes."

"Wait, now, Ed. I think you're exaggerating about the 'parlor stuff.' All the Taylor people are doing is providing a decent room where the foreman can meet the man and talk without a lot of embarrassment to the applicant. Seems to me the man will appreciate the square treatment right at the start, instead of being treated like the morning lineup at police headquarters. If the foreman has a square talk with him ahead of time it ought to mean that there will be fewer firings afterward. Of course the foremen aren't supposed to be dressed up when they're working, but seems to me a lot of them need jacking up a bit."

"Seems like you always fall for the new stuff, Al. I don't."

Does it pay to extend courtesy outside to the applicant for a job? Should the foreman talk with the applicant, or was Ed right in saying that the man would expect too much afterwards?

All foremen are urged to discuss these questions vital to their work; of course the

discussion is not limited to foremen. Letters accepted and published will be paid for

Discussion of Earlier Topics

Paying More to Save Money

AFTER all, Al is not being paid his salary solely for getting out production. The major part of his contribution to his firm is his brains. Al is far enough away from the engineering job to bring an entirely new and useful slant to the problem, as he has in this instance. To assume that the engineers will resent this is just as unfair as to think of Al's co-operation in terms of interference. Industry as a whole needs badly more foremen like Al, and will certainly welcome such constructive thinking. —S. R. Brewer, Jr.

NEARLY every shop foreman is occasionally confronted with the same proposition as Al. In my opinion, it is his duty to try to have the specifications changed. Without doubt it is the designer's duty to specify materials which enter into a product. Frequently, however, the designer loses sight of the fact that a better grade, or a different material, or other change from standards, will result in fewer machine hours, thus releasing machines for other work. Much confusion and delay would be avoided if the designer at all times consulted with the shop foreman in making up specifications. —R. H. Kasper.

SUGGESTIONS from the shop are often of great help to the designer, and the manufacturing departments should be encouraged to submit such suggestions. This applies to the shape of parts as well as to the use of materials.

Every designer, broadminded enough to admit his own mistakes, would welcome the suggestion of the screw-machine man in the case presented. In a similar way slight changes in the design will often afford substantial savings on tool or pattern costs. Probably even more important than the immediate saving is the training of the designer to consider production costs in the first place. —Peter A. Brill.

INFALLIBLE designers are scarce. Ed should not hesitate to propose changes. Most designers are glad to hear of any improvements, for this is a part of their education in shop practice, something which the average draftsman does not have a chance to acquire directly. Even when the idea cannot be adopted, the person making the suggestion can learn something by talking things over with the designer.

Revising the drawing is comparatively inexpensive, although many workers refrain from offering ideas because they feel that the drawing has to be made all over again. Blueprints cost only a few cents apiece, and most alterations involve less than a couple of hours of the draftsman's time. Any worthwhile change soon pays for the slight cost necessary to make it.

A. Herrman.

THE worker should not interfere with designs. He should call the attention of the proper authority to any improvements that he feels will speed up production, but it should be made clear to the employee that, when the job was planned, each part was considered in its relation to the remainder of the job and the succeeding operations. Other operations may be interfered with, and production hopelessly tied up, if one man's idea for improvement be adopted without considering the relation of that particular operation to the whole job.

The idea suggested by the screw-machine man of changing certain parts from steel to brass so that he can speed up production, should be brought to the attention of the designer. The company should show its appreciation for this idea by suitably rewarding the workmen. A choatic condition would result if the worker or foreman attempted to interfere with designs themselves.

—Joseph Bell.

THE · NEXT · TOPIC

Shall the Men Support Their Own Club?

ADVANCE QUESTION

Ed waxes enthusiastic over a shop club where the company pays all the expenses. Al feels that it is better to have the men help to support it. Who is right?

Keeping a Machine Busy

THE following system is employed by one wide-awake concern. A card record is kept, in the superintendent's office, covering the amount of work which each machine is capable of turning out, the number of years it has been in operation, and a record of all maintenance costs. When a machine reaches its estimated life the card is withdrawn, and a search is made for a new piece of equipment to replace it. If preliminary data on the new equipment is favorable, the manufacturer is requested to send a representative. Upon his arrival, the superintendent, production engineer, foreman of the job in question, and the purchasing agent are called into consultation. In this conference the machine is discussed from every angle. Would it pay for itself over a certain period of time? Could it be kept busy 80 per cent of the

time? How much floor space? Method of drive? What is the comparative life? These are some of the questions asked.

If the machine still looks favorable, a representative is sent to some nearby shop to make a study of one of the proposed machines in operation. If his report is favorable, the new machine is purchased and the old one junked. There are times when a machine which has completed its estimated life is found to compare favorably with new machinery on the market, and is kept in operation for a long time afterwards.

—Fred. Aug. Schmidt.

THIS question is not unlike that of skilled versus unskilled labor. On many tasks performed by relatively unskilled labor, the cracker-jack mechanic could produce a greater volume in a day. However, just as long as the labor cost of the unskilled laborer is sufficiently less per unit of production than that of the expert, we do not favor changing. So it is with the machine. To solve the problem in a given case we must compare the actual machine costs per unit of production. The depreciation and yearly interest on the principal must be divided by the estimated number of parts to be produced annually, and added to the unit labor cost. Unless this comparison shows up decidedly in favor of a new machine, the old should be retained. As long as production does not approach the maximum capacity of the machine, depreciation will be a major factor and obviously will be greater on the new machine. —Earl L. Fairali.

Helping the Efficiency Engineer

MANY plants have excellent efficiency engineers in their own organizations under the titles of shop superintendents, foremen, and shop engineers. These men should let their minds drift from the regular production of the shop, and paint a mental picture of improved conditions. Let one of these men imagine all the hungry line shafting and belts replaced with direct drives, all the antiquated machinery replaced by modern efficient tools, old pet junk shipped to the scrap heap, equipment grouped to cut handling costs to a minimum, an efficient tool checking and routing system, and some form of amusement for dinner hour. When he has completed his study let him lay it before his superiors for approval.

Plant officers should be better qualified to do this work than professional engineers if they will take hold and study the job. Of course, if the firm hires an efficiency engineer it becomes the duty of the foreman to assist in every possible way. —E. C. Gaines.

THE efficiency engineer is in a very difficult position, since he is sure to arouse the jealousy of some of the foremen, no matter how good he may be. He must be tactful, if he is to succeed under such a handicap. The chances that he is taking advantage of every opportunity to belittle the foremen's ability are remote, since he must be a square shooter or he would not last long in his difficult position.

If the foreman shows a tendency to assist the efficiency engineer, the engineer in turn will consult the foreman about changes he considers feasible. There is, without doubt, room for improvement, and if the foreman and efficiency engineer work together, both the firm and the employees will benefit immensely. —Wm. J. Owens.

SINCE the efforts of the efficiency engineer will be devoted toward the improvement of product, working conditions, reduction of fatigue, and other matters including the determination of an equitable basis for payment, the foremen and workmen should, as a matter of self-interest, render all possible assistance to the newcomer. The engineer will be helped greatly by the views and suggestions of men who are in close daily contact with the particular work in process. He will ask questions relative to the work and conditions which might not easily occur to insiders.

—T. Pilkington, *Canada.*

THE efficiency engineer was introduced into industry at a time when modern production methods were first coming into use. It was still common practice to hire all executives and foremen from outside the organization. It was still an optimist's dream that suggestions from the men could be encouraged, and that foremen should visit other plants. The efficiency engineer capitalized on the situation.

The foreman of today, who has been taught to think in broad terms, who has come up through the shops, and knows details intimately, may often contribute more as the result of his visits to other firms' plants and observing their processes than the efficiency engineer. Being permanently on the job, the foreman can work up his own changes, rather than leave them to someone else to put into effect. Finally, he can adapt his ideas to meet changing conditions, since he stays on the job.

—John A. Thomson.

Monthly Checks on Workmen's Ability

I DO NOT agree with Al that ten items on the card would be better than thirty. The greater the number of items the more reliable the report will be. If the card were divided into columns headed bad, poor, fair, good, and very good, the foreman would need to check off only the appropriate squares. If a thick vertical line were drawn between fair and good the number of marks to the right would indicate above the average, and to the left below the average. Joining the checked squares would form a graph which could be read easily, thus showing at a glance the man's general ability. This would help Williams who might get fed up with his own scheme if he had to read through long lists when judging. Possibly the position of the average line could be made variable and put in according to which foreman filled in the card. It would be found that some foremen tend towards the higher mark, and others toward the lower mark, as an average. —Albert F. Guyler, *England.*

Paying a Bonus to Outsiders

I THINK that the operator mentioned would not quit, as he has the same opportunity as the man making the suggestion. Neither would he feel piqued. If a good

suggestion system is installed, the results would be gratifying to the operator and to the company. Such a system would invite all operators to make suggestions, and would pay them a certain percentage of the first year's net savings, which means that necessary tools or equipment must be paid out of the savings.

By all means pay for suggestions. Encourage them. However, I believe a suggestion committee should be appointed to pass on suggestions. They should not be turned over to any one person, and should be treated confidentially until acted on by the committee.

—R. JACOBS, *Secretary of Suggestion Committee.*

Too Many Safety Signs

THE indiscriminate use of safety signs will surely defeat the purpose for which they are intended. When displayed in the same place for any length of time they become part of the surrounding scenery and are not noticed by the average person. In the case of ever-present hazards, however, permanent danger signs of a conspicuous character must be located at the danger point.

To obtain the best results from safety bulletins and slogans, they should be displayed on a bulletin board in a conspicuous place arranged in an attractive manner, and changed at frequent intervals. In addition, safety slogans may be used on the time clocks. Such bulletins should be attractive, and the message they convey must be short. —WALTER CHARLES, *Safety Engineer.*

Do Brains or Beef Count Most?

THE day has passed when it is profitable or possible to hire men, use them up, and replace them with fresh material when the time of exhaustion has come. Industry moves too rapidly for it to be policy to scrap experience.

If a vacation, or even a prolonged vacation or leave of absence, is not sufficient for a man like Sam Buckley, and he cannot stand the strain of the same old job, it would be a mighty fine thing to arrange for him a definite course of visits among other industrial plants. His experience and skilled observations would enable him to acquire fresh conceptions of useful applications which could be used to excellent advantage in enabling his own company to keep abreast of the times. Most industries are friendly to the exchange of visits, and through trade expositions, equipment shows, and the like, it should be possible to produce a very high grade and valuable sort of position for him, either in a management way or in a staff connection with the management.

—D. C. WRIGHT.

TWENTY years of experience leads me to say "Do not train an understudy." It is a very rare thing to find an understudy both loyal and efficient. As soon as he becomes able to take the job of his superior, he becomes restive and wants the real job. The result is that he finds little things to say to the ones higher up, that give them the impression that the regular man is not all that he should be. Perhaps advantage is taken of the understudy's stories, and the foreman prodded by saying, "Your assistant did a mighty fine job while you were out. He made a couple of fine suggestions that seem to show very good capacity for leadership."

The result is that the foreman thinks that the understudy is after his job, and ill feeling arises. Neither one of them from then on is able to give the firm his best efforts. Honesty, harmony, and loyalty are the cornerstones of success in business. They cannot be gained by holding out the threat of, "We've got a good man ready to fill your place." —CHARLES H. WILLEY.

IN A CASE like Sam's a "get-together" of the men higher up with Sam should have been arranged. I know of a similar case where a good man found himself up against it because of poor health. This man had it out with his boss when he felt himself slipping. In consequence it was arranged to give him a job in a place where he did not have to be present every day. To make it still more fair, the man himself suggested that his salary be changed to an hourly rate. All concerned were satisfied.

If Sam and his superior officer had gotten together, no doubt they might have arranged a consulting job for him, since he is the type of man that could pull a firm through dangerous periods. Letting him go, as was done, is going to react very seriously on the man who stepped into his shoes. The new man is not going to hurt himself on the job. —J. C. P. BODE.

How Much to Spend for Repairs

RECORDS should be kept of the maintenance and repair cost of each machine, and these costs should be counted up annually. The result will give an indication of the annual maintenance cost of these machines.

By examining the records yearly, the annual maintenance cost of each machine may be compared with the cost of a new machine. When the annual maintenance cost becomes double what it was during the second year of the machine's life, the machine should be considered for replacement. It is for the management to decide whether a machine should be repaired or replaced. The foreman can do little more than point out the costs and inefficiencies, and make recommendations.

—W. E. WARNER, *England.*

Something Besides the Pay Envelope

EXPERIENCE has taught me that the majority of men who are getting reasonable pay will soon get interested in their shops and jobs if their interest is encouraged and helped a little. Telling the men about the plant encourages them to familiarize themselves with all that it concerns.

Although it must be confessed that a big part of the men feel more interested in their pay envelopes than in their work, it is also true that most men have other feelings and necessities than money. If good wages are paid, we believe the system of Williams will help. Little things help the men to sympathize with their shop, and with their superiors. The cost of such little things is very small compared with the results obtained.

—M. L. J. JOCHEM, *Holland.*

Stabilizing Employment

By A. H. Rodrick

Both employees and employers are responsible for instability in employment, but employers can improve the situation by better advance planning

WE HAVE heard much about stabilizing business, stabilizing industry, and stabilizing prices, but not so much about stabilizing employment. The most essential part of business and industry, therefore, seems to be receiving the least consideration. That capital and labor, or employer and employee, or management and men, are each helpless without the other, is an economic fact. That capital is obtained through the production of labor, and that labor is obtained through the offer of capital, is a fundamental principle well established. The employment of human beings is so manifestly indispensable that serious thought must be given to its stabilization if business and industry are to operate on a better and more profitable basis. Unstable employment is caused by employees, by employers, or by business and industrial depression. Employees are sometimes responsible for conditions of unemployment by making their own employment irregular. This is brought about by strikes, voluntarily quitting because of personal grievances or dissatisfaction, and by what may be called "floating." According to statistics made public by the United States Department of Labor, there were in effect at the end of each month from June, 1927, to December, 1927, a total of 398 industrial disputes, involving 1,028,339 workers, resulting in the loss of 27,034,746 man-days. These figures represent a monthly average of 56.8 disputes, involving 146,905 workers, and a loss of 3,862,106 man-days.

The effect of a strike is not only felt by those who participate in it, but it spreads to other employees who have no interest in the subject. As a result some leave their places of employment in sympathy with the strikers, while others are discharged because of the business and industrial depression brought about as a consequence of curtailed production. In such cases innocent workmen are forced into a state of unemployment, with its attendant hardships to their families, without even so much as being a party to the controversy or interested in its outcome.

Unemployment brought about by employees voluntarily quitting because of personal grievances or dissatisfaction does not inflate in a large degree the condition, yet it does play its part. A man who harbors a grievance or is continually dissatisfied with his work finds it difficult to get a job, for an employer hesitates about adding such an individual to a contented working force. If he left his former employer for this reason there is no assurance he will not repeat the operation with a subsequent employer at the slightest provocation. The agitator also finds it difficult to obtain employment when he is out of work. Men whose employment is habitually unstable because of "floating" do not make dependable citizens. They work when they feel like it and where their fancy dictates. They are independent as to their time and place of employment, also their length of service. They are seldom an asset to a community for they do not settle long enough to benefit or improve it. The employer who wants to maintain a steady working force must avoid this particular class. The part employers can play in stabilizing employment is the problem with which we are most concerned. Can employers stabilize employment, and, if so, what benefits would be derived therefrom, aside from those accruing to society in general as a natural result? These are the questions to be answered. We plan our production, we plan the purchase of our material, but we do not plan with the same carefulness, our employment. If the planning department estimated the cost of jobs to be one-half less than the actual figure, and the time required to complete those jobs to be one-half less than the actual time taken, something would happen in the planning organization. If the purchasing department carried no stock on hand and bought on a rising market when by a little forethought the same material could have been purchased on a declining market, something would happen in the purchasing organization. Yet labor can be taken on and let go indiscriminately and less attention is paid to the enormous loss incident to such an unsystematic practice.

> The acquisition of machinery and materials is usually very carefully planned, but many managers have not yet realized that the employment of men requires even more consideration and careful planning if stabilization is to be fully attained

Three factors enter into the cost of doing business, namely, labor, overhead, and material. These factors are mentioned in the order of their relative importance. The employment and maintenance of labor, as well as the amount to be spent for this purpose, deserves more planning than production or the purchase of material, because the employer's payroll is his greatest item of expense. And yet it is often receiving the least consideration. The employer who has not given serious thought to labor planning will find it as simple as planning any other branch of his business.

Many are eager to enlarge their working force at the slightest additional increase in business, and as a result the organization sometimes becomes top-heavy. Very often the extra work, with present supervision, could be

completed within the contract time of delivery by the force the employer already has if he knew the capabilities of his employees. It should not be forgotten that hiring men has its determinate and indeterminate expenses. Some of these are: Clerical cost incident thereto, cost of training new employees, errors in workmanship and spoilage of work, wear and tear on machinery, decrease in general efficiency of the organization due to the presence of inexperienced men, reduced production, and increased danger of accidents. In a large enterprise where no centralized employment office is functioning, moreover, one department will be hiring while another is discharging.

A workman should not be added to the payroll until as much thought is given to the necessity for it as is given to the necessity for the installation of an additional piece of equipment or to the purchase of additional material. The cost of a new employee is often greater than either of these. An efficient manager will not order an additional amount of a particular product until he has ascertained how that article is moving, and what the probable forthcoming demand will be for it. The application of the same logic to the human element in industry and business is good management. Before increasing the force for any purpose two questions should be considered. Can the present force take care of the additional work? and If the force is increased or vacancies filled can future employment be reasonably assured to those who may be employed?

Men Not Always Working at Highest Efficiency

Many a man is capable of a greater amount of production than he is really giving, and it must be conceded that many employees do not work at their highest efficiency. Samuel Crowther pointed out that "almost any workman interested in building something for himself will, after a long day's work, start at his own task with a fresh energy and probably do more work after the day has officially closed than he did during the time for which he was paid." There are fast producers and slow producers, accurate producers and careless producers. There are those who can produce in large quantities without impairing the quality of the product. Material is carefully tested and the specifications for same insisted upon, but workers are receiving less thought than inanimate objects. Thousands of dollars are spent to purchase and install machinery to increase efficiency, and then inefficient operators are assigned to those machines. Men should be analyzed to determine what they can do without undue strain or fatigue. When this has been done steps should be taken to reassign the work so that the average producers will absorb the work performed by those below the average. Such a reorganization will eliminate the slow workers who are a drag to production, and the amount saved on the cost of production will be surprising. It is the fear of unemployment that naturally inclines the operator to make his work last as long as possible.

When it does become necessary to increase the force, much thought should be given to the number of additional persons actually required, and whether business conditions are such that something can be offered in the way of continued employment to the new workers without jeopardizing the future of those already in the organization who have been loyal and efficient. This question should not be considered lightly, for an employer must not lose sight of the fact that when he goes into the open market he is compelled to choose from whatever material is available at the time. If the planning has been such that reasonable future employment can be offered those who apply, competent applicants satisfactorily placed elsewhere may be willing to make a change, otherwise the employer must take what there is, among which is bound to be the "floater" type. The employer has a job to fill; the desirable employee always has his services to sell. The latter is desirous of making the best contract, and unless the offer indicates permanency there is no attraction. When hiring, employers should aim to secure the most efficient help possible, and then strive to retain them. Turnover is estimated to average between $25 and $300 according to the kind and size of establishment.

There are, of course, times when employees must be taken on for temporary or job employment. When such emergencies arise those selected should understand the nature of their connection with the comapny. It is well to fix approximately the length of such an assignment, say thirty days, or two months, and so inform them. It is manifestly unfair to mislead an applicant into believing that his employment is to be permanent when it is not so. Such conduct is bound to react at a later date.

The periods of depression which visit all classes of business at some time cannot be prevented by either the employees or employers. They are risks which can be expected but not avoided. The employer who has planned his employment is in a better position to cope with such a situation than one who has given no thought to stabilization.

The contented employee has a positive money value, and one of the ways to keep him so is to "remove the nightmare of unemployment from his pillow." Employers are cautious about reducing wages because they know it affects morale; they should be just as cautious about reducing the force. The latter has the same effect as the former. It costs money to discharge workmen just the same as it does to hire them. To discharge is very often false economy; but failure to hire when the additional help is not actually needed is true economy. I once heard of a manufacturer who was compelled to reduce his force several times before he could effect a decrease in production. At each reduction the remaining workers speeded up to avoid being chosen in the next layoff.

Unemployment Will Always Exist

Unemployment in a certain measure will doubtless always exist, and we can only strive to reduce it to as low a minimum as is humanly possible. The committee appointed by the Department of Commerce to investigate the building industry situation reported that "custom, not climate, is mainly responsible for seasonal idleness in the construction industries. Tradition, therefore, rather than reason, is responsible for that seasonal inactivity which affects the 11,000,000 persons of this country who depend on the building industry for their living. The question of unemployment has been stated by Owen D. Young, Chairman of the Board of the General Electric Company, to be "the greatest economic blot on our capitalistic system," and continuing, he said that "there is no answer except that the managers of business have not yet learned how to make their system function so that men willing and able to work may do so." To stabilize employment employers must plan their employment problem with the same zeal as they plan production and purchase—it cannot be achieved in any other way. The same commonsense principles apply.

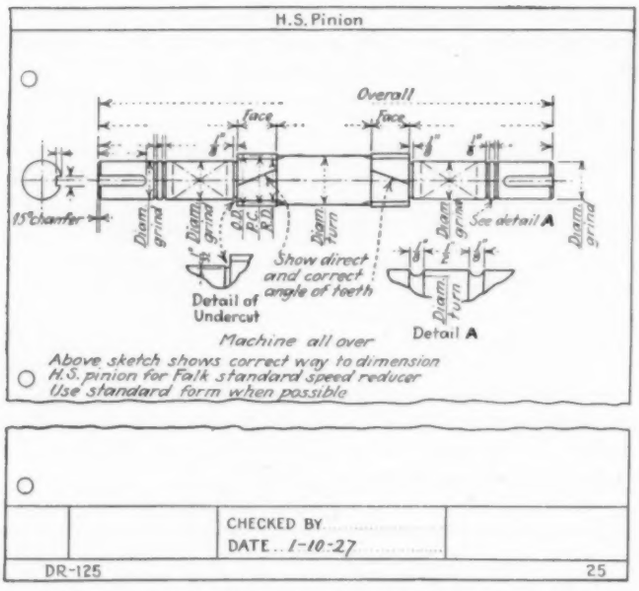


Fig. 1—An instruction sheet showing preferred method of dimensioning

Reducing Drafting Errors

By Hyman Levine

Errors made in the drafting room are not cured simply by "calling down" the draftsman and "jacking up" the checker

THE Falk Corporation, Milwaukee, has made a study of the drafting room errors discovered within its plant over a period of years, and has developed a system of procedure and checking that has effectively eliminated most of the major errors and has reduced the minor errors to a minimum.

The opinion was prevalent that drafting-room errors were due entirely to careless drafting and incompetent checking, and that all that was necessary to improve conditions was to replace the draftsmen and scold the checkers. Careful study of the situation revealed that this attitude was only partly correct. While some mistakes that found their way into the shop were undoubtedly the result of carelessness on the part of the draftsman and lack of attention on the part of the checker, they were found to be but a small portion of the total.

Too Much Memory Work

In the ordering of any piece of mechanism it is always necessary to meet a number of requirements. Parts must be designed of the proper strength, and to avoid interference; tolerances must be close enough for the necessary accuracy and liberal enough for economical machining; provision must be made for lubrication, drainage, expansion, inspection, dismantling and repairs; all of the required parts must be specified on the bill of material; patterns, forgings and castings must be ordered from the proper sources; certain shop preferences must be remembered and adhered to; prints must be sent to the customer for record or approval; and a number of other details must be taken care of, depending on the plant conditions. It was found that the largest number of drafting-room errors was due to an oversight of one or more of these items. Each clerk, draftsman and checker conscientiously tried to remember all of the requirements, but the items were so numerous that the men could not carry them all in their heads.

Another difficulty of serious magnitude was the practice of customers revising their requirements while the order was in process either in the drafting room or in the shop. Often the order was received with incomplete information, and it was necessary, in order to meet delivery dates, to do as much of the work as possible with the information at hand, following up later with additions or revisions. When such a change comes in, attention is concentrated on the item mentioned in the correspondence, and it is very easy to forget that some other item might be affected by the change.

When these conditions were analyzed and understood, the remedy was clear. It was necessary to list all the requirements as they could be used for continuous reference, to provide for systematic checking of all work in the light of these requirements, and to arrange a

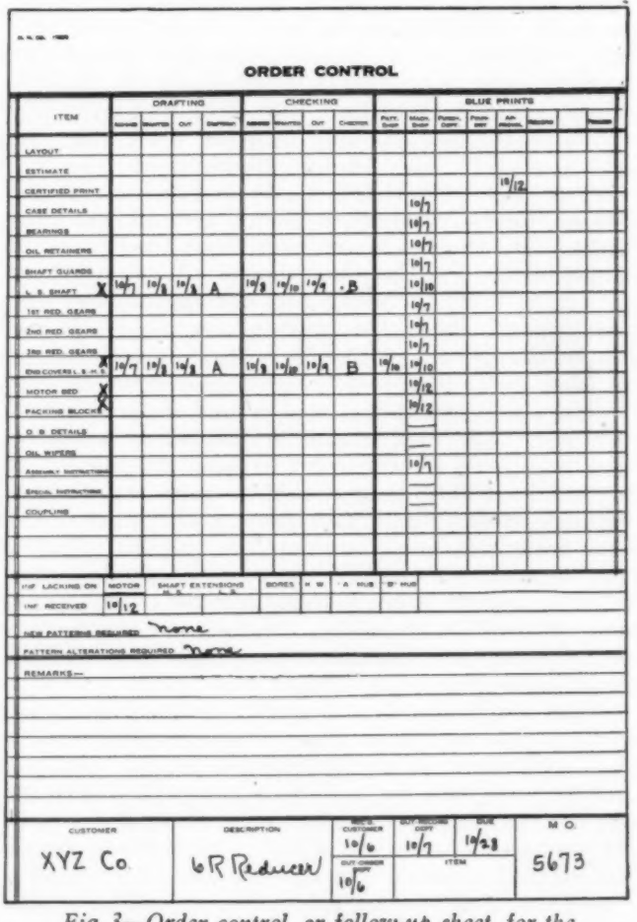


Fig. 3—Order control, or follow-up sheet, for the drafting room

follow-up system and for revisions for incomplete orders.

An instruction book was prepared giving the preferred ways of doing work, certain shop practices, the requirements of special customers, and other rules of importance to the drafting room. A copy of this book was given to each employee. As new conditions arise, sheets are added to these books so that they are at all times kept up-to-date.

To obtain systematic checking a number of checking forms were prepared for each type of order handled. Each form lists a number of points that must be considered before putting through the drawing and specifications for a given order of that type. The original questions were prepared from the study of the errors complained of in the shop, and to these were added some others that it appeared reasonable to consider. The checker uses a questionnaire with each order, marking each item as he checks it. Because each questionnaire must be signed by the checker and is filed for future reference it fixes the responsibility on him for any errors that he allows to pass, and leaves no room for argument, should trouble develop. In Fig. 1 is shown a checking form used with orders for speed reducers, and in Fig. 2 is shown a sheet from the instruction book, which gives the preferred way of dimensioning a pinion.

To provide for systematic follow-up of incomplete or revised orders, two additional forms were prepared. One gives a history of the order from the time of its receipt from the customer to its completion in the drafting room; the other gives a list of records that must be changed and departments that must be notified when revisions are necessary. When an incomplete order is received, such parts as are standard are ordered immediately, and so recorded on the control sheet; parts that are known but must be made special are indicated so as not to be overlooked; and parts that are not known are placed on the "waiting list." Should revisions be necessary they are entered on the revision record, giving an explanation of the change, and indicating what departments or records are affected. It is not always necessary to make all notations immediately; some can wait for a later or more opportune moment; but the revision sheets are kept in a book until all notations are made, so that no items are forgotten.

The entries on the bottom of the order control, Fig. 3, indicate that the order was received October 6th and went to the drafting room for detailed analysis. A number of items such as bearings and gears were standard, and were ordered immediately. The crosses on the left indicate that the low-speed shaft and some other parts could not be ordered immediately, but would have to be watched. The record shows that the low-speed shaft and end cover were drawn up, checked, and ordered by

CHECKING SHEET—H. D. AND R. UNITS

CUSTOMER	DESCRIPTION	M. O.

INSTRUCTIONS TO CHECKERS

READ ORDER ISSUED TO DRAFTING ROOM AND NOTE UNUSUAL FEATURES. IF ANYTHING APPEARS QUESTIONABLE, BE SURE TO INVESTIGATE IT BEFORE RELEASING THE ORDER. IT IS THE CHECKER'S DUTY TO OBTAIN AND EXAMINE ALL DRAWINGS, BILLS OF MATERIAL, DESCRIPTION SHEETS, PATTERN ORDERS, ASSEMBLY INSTRUCTIONS, PLANT COMMUNICATIONS, AND OTHER DATA NECESSARY TO MAKE A COMPLETE AND THOROUGH CHECK OF THE ORDER.

ON STANDARD REDUCERS, ANSWER THE QUESTIONS IN THE LEFT HAND AND RIGHT HAND COLUMNS. ON SPECIAL REDUCERS, ANSWER ALSO THE QUESTIONS IN THE CENTER COLUMN SO FAR AS THEY APPLY.

CROSS OFF QUESTIONS THAT DO NOT APPLY. CHECK OFF EACH QUESTION AS IT IS ANSWERED. LIST MAJOR ERRORS FOUND. UNDER "REMARKS" ENTER SPECIAL ITEMS TO WHICH ATTENTION SHOULD BE CALLED.

SIGN AND DATE QUESTIONNAIRE WHEN CHECK IS COMPLETED, AND SUBMIT FOR O. K. IT WILL BE FILED FOR FUTURE REFERENCE.

STANDARD REDUCERS

REDUCER

1 ARE ALL BILLS OF MATERIAL ON UNIT SAME AS SPECIFIED ON MASTER LIST FOR REQUIREMENTS OF ORDER?
2 ARE MAIN CASTINGS CORRECT FOR SIZE OF UNIT?
3 ARE BEARINGS CORRECT FOR SIZE OF UNIT?
4 ARE OIL RETAINERS CORRECT FOR SIZE OF UNIT?
5 ARE SHAFT GUARDS CORRECT FOR SIZE OF
AFT CORRECT FOR SIZE OF

DO BILLS FOR DOUBLE ENDED H. S. SHAFT AND SINGLE ENDED L. S. SHAFT? DO BILLS CALL FOR END COVER IN PLACE OF SHAFT GUARD ON L. S. SHAFT?
25 DO LOCATION OF MOTOR AND SIZE OF SPROCKET PERMIT OR PROHIBIT USE OF DOUBLE ENDED H. S. SHAFT?
26 IS H. S. END COVER ORDERED IN PLACE OF SHAFT GUARD IF H. S. SHAFT IS SINGLE ENDED?

SPECIAL REDUCERS

DUSTPROOF OIL RETAINERS

27 ARE DUSTPROOF OIL RETAINERS PROVIDED IF UNIT IS FOR CEMENT MILLS?
28 IS CLEARANCE BETWEEN COUPLING AND OIL RETAINER SUFFICIENT TO PERMIT REPLACEMENT OF PACKING?
29 ARE DUSTPROOF OIL RETAINERS CORRECT FOR SIZE OF UNIT?
30 ARE CERTIFIED PRINTS CORRECTED FOR SHAFT EXTENSION CHANGE?

SPECIAL SHAFT EXTENSIONS

31 IS H. S. PINION EXTENDED ACCORDING TO
EXTENSION ACCORD

PATTERN ORDERS
NEW PATTERNS REQUIRED?
53 HAVE PATTERN ALTERATION ORDERS BEEN WRITTEN FOR ALL ALTERATIONS REQUIRED?
54 HAVE PATTERN RECORD ENTRIES BEEN PROPERLY MADE?

SPECIAL CUSTOMERS

55 ARE UNITS FURNISHED FOR CUSTOMER WHO REQUIRES SPECIAL FEATURES?
56 ARE ALL OF CUSTOMER'S SPECIAL REQUIREMENTS COMPLIED WITH?

ALL REDUCERS

CERTIFIED PRINTS

57 ARE TYPOGRAPHICAL ERRORS ON CERTIFIED PRINTS CORRECTED?
58 IS UNIT INDICATED SAME AS ORDERED?
59 IS REDUCTION RATIO INDICATED SAME AS ORDERED?
60 IS MOTOR BED INDICATED SAME AS ORDERED?
61 IS COUPLING INDICATED SAME AS ORDERED?
62 IS DATA WRITTEN IN BOTTOM BLANKS CORRECT?
63 ARE ALL SPECIAL ITEMS AND CORRECTIONS PROPERLY SHOWN?
ARE PROPER NUMBER OF COPIES MADE?

REMARKS:

DATE_____ SIGNED_____

Fig. 2—A typical checking sheet for drafting room use. Th checker is required to check each item as he proceeds, and the sheet is then filed as a permanent record until the job is completed in the shops

REVISION RECORD

DESCRIPTION	REQUESTED BY	DATE
Make L. S. shaft 1" longer.	Customer	10/14

	ORIGINAL DRAWING	COMPONENT PARTS	SIMILAR PARTS OR FROM SAME PATTERN	BILL OF MATERIAL	ASSEMBLY DRAWING	
TRACING	✓ 10/15					
DWG. NO.						
REVISED CARD	✓ 10/15					
B. P. TO SHOP	✓ 10/15					
B. P. TO PUNCH. ASSN'T						
PROD. ENG.						
B. P. TO CUSTOMER	✓ 10/15					
B. P. FROM SHOP	✓ 10/19					
B. P. FROM CUSTOMER	✓ 10/20					
B. P. TO ORDER DEPT.						
B. P. TO PATT. SHOP						
PLANT COMMUN.						

REMARKS

SIGNED C. D. DATE 10-20

CHECKED H.F. DATE 10-20

M. O. NO. 5673

Fig. 4—A drafting department check-up of a customer's revision

October 10th, but that the motor bed and packing blocks were held up waiting for motor information which the customer was to supply. This information was received on the 12th, the parts were promptly ordered, and the customer was sent a certified print giving foundation dimensions. The revision record shows that for some reason the customer decided to lengthen the low-speed shaft, and that it was necessary to watch at least six places in putting the change through. Such items as could be controlled in the drafting room were taken care of the day following receipt of the order change, but it was necessary to wait several days longer before the old print was returned from the shop, and the approval print from the customer.

The results of this systematic method of attack against the problem soon became apparent. The instruction books, checking sheets, and follow-up record were accompanied by a careful training of the personnel in their proper use, and reduced to a minimum the occurrence of drafting-room errors. Furthermore, because the instructions were all in writing, it was found easier to train apprentices and break in new men. Because the checking questions were all listed it was also found possible to shift checkers from one class of work to another, and to train younger men to checking responsibilities.

If products containing imported material on which duty has been paid are exported, the manufacturer is entitled to 99 per cent of the duty paid on the imported material according to the provisions of the tariff act now in force. It is not required that the manufacturer be the actual importer of the material used or the actual exporter of the product.

SEEN · AND · HEARD

By John R. Godfrey

Hollow Forgings—Gages—Breaking in Bearings

CHANGES in production processes frequently affect other lines of industry as well as the one directly involved. Making pieces from bar stock, for example, eliminates the need for cutting off and centering, and the machines necessary for these operations. Hollow forgings reduce the amount of machine work formerly necessary when the piece was bored from the solid. Going a step farther, we have the new forgings made by piercing holes so closely to size that they require only broaching to bring the holes to accurate dimensions. Both materials and machining operations are conserved and costs are lowered.

The new forgings also go a step farther. The piercing punch that almost finishes the center hole also forces the displaced metal to fill the dies and in so doing compresses it and helps to secure a forging that is more dense near the center. Incidentally, it also saves steel over the old method.

* * * *

Gages are being used to a greater extent each year, and gage makers are being asked to maintain closer tolerances than ever before. Some of the tolerances demanded are in fact so small as to cause serious doubts as to the customer's ability to measure them. When it comes to splitting "tenths," as some demand, the gage maker gets a bit skeptical at times.

Gage hardness is another point in dispute. Demands for a 90 scleroscope-hardness are common, but some gage makers doubt its advisability. Some of them claim that a gage having a 70 scleroscope hardness will wear equally as long, if the gaging surface is really smooth. In fact there are many who place smoothness above hardness. For best results in wear-life, some makers are very fussy about polishing the gages to a mirror finish, after lapping them to size.

* * * *

Lapping and grinding gages is another point on which there is no fixed agreement. The latest notion is to try the type of hone used in finishing cylinder blocks, for ring gages. This hone, or grinding head, as one maker calls it, can be made to give a mirror finish if the abrasive is of the proper grade. True, there are minute marks that appear as scratches because they follow a spiral path. But it is safe to say that these scratches are too shallow to be of any consequence in either measuring or wear. This method of finishing is being seriously considered by some gage makers.

* * * *

There seems to be wide differences of opinion about running-in new machinery. Some makers advise running it slowly for a time in order to limber up the bearings and get them thoroughly worked in. Others contend that if the bearings are fitted right and are kept well lubricated, there is no need of nursing the machine at the start. It seems probably, however, that bearings run carefully at first, can be fitted with less clearance.

Safety Code for Power Transmission

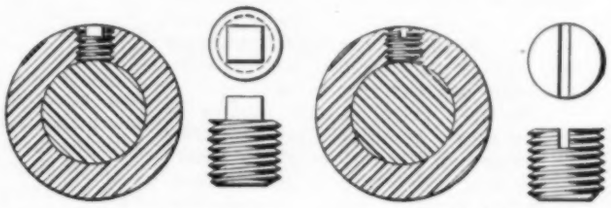
Approved by American Engineering Standards Committee

All projecting keys, set screws, and other projections in revolving parts shall be removed or made flush or guarded by metal cover. It is recommended that no projecting set screws or oil cups be used in any revolving pulley or part of machinery.

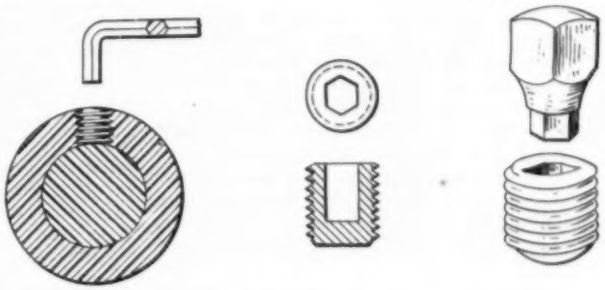
All revolving collars, including split collars, shall be cylindrical, and screws or bolts used in collars shall not project beyond the largest periphery of the collar.

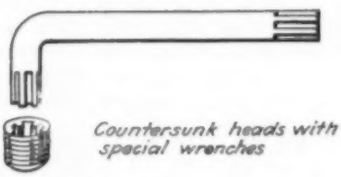
Shaft couplings should present no hazards from bolts, nuts, set screws, or revolving surfaces. Bolts, nuts, or set screws are only permitted where they are used parallel with the shafting and are countersunk, or else do not extend beyond the flange of the coupling.

Shafting located 6 ft. or less from the floor or working platform should be protected by casings. Shafting under benches should be enclosed by a stationary casing. Self-lubricating bearings are recommended. Shaft ends should be smooth, and should not project more than one-half the diameter of the shaft unless guarded.



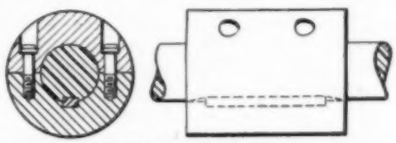
Square head — Slotted head



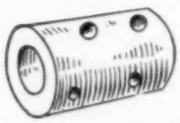


Countersunk heads with special wrenches

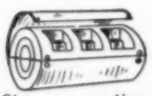
Safety Set Screws



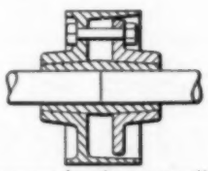
Split coupling



Solid sleeve coupling

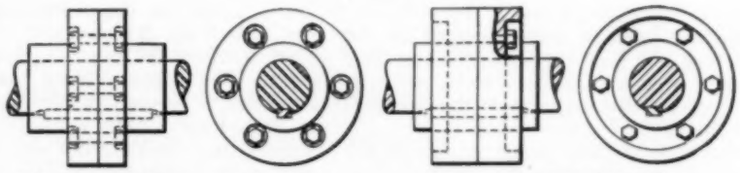


Clamp coupling with safety sleeve



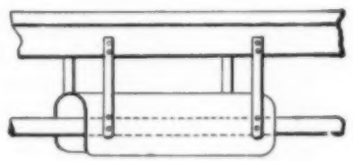
Compression type coupling

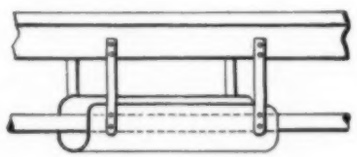
Shaft Couplings

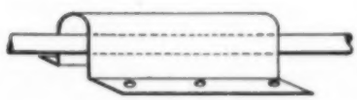


Bolt heads and nuts countersunk — Flanges project beyond bolt heads and nuts

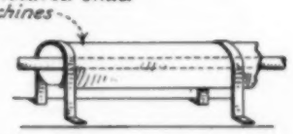
Flange Couplings







Shafting located under bench machines



Trough Guards for Shafting

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· TECHNICAL · ABSTRACTS ·

Types of Failure in Steel

Steel fails in many ways, depending upon the character of the metal and the conditions of service. Such failures when carefully studied often indicate that radical improvements are necessary to insure satisfactory service.

Slips take place in mill practice or in the shops, resulting in a deficiency of strength or ductility or in the ability to endure under stress, and in consequence material oftentimes goes into service predestined to fail. Only failures resulting from unusual slips in practice will be treated.

Hair cracks will develop in shafts at fillets which have been carelessly machined. A narrow angle centers the stresses, and will cause ultimate failure. Good practice requires a wide angle at the fillet and a gentle slope. Even rough turning at this point is dangerous.

Severe residual torsional stresses imposed by careless heat-treating will often split large steel pieces without any appreciable loads being placed upon them. In such cases, a series of longitudinal lines will indicate this condition, which can be brought about in two ways. A cold piece may be placed directly in a hot furnace without gradual warming, or a hot piece thrown into a cold quenching tank and permitted to lie upon the bottom.

Casehardened parts having a too-high percentage of carbon tear apart when drastically cooled. A spiral appearance of the break indicates a fracture of this type.—Robert Job, *Transactions*, American Society for Steel Treating, August.

Economies in Automatic Welding

"How can operations be speeded up to obtain the maximum output at minimum cost?" This is the important question in automatic welding, and the answers lie in the following topics for consideration.

The rate of electrode feed was studied and a bead on a flat plate was used in order to eliminate other variables. Increased speed in welding, obtained by raising the current, effects a saving in welding cost. Likewise changes in electrode diameter and type will mean a saving. The control of an automatic welding machine is so devised that practically any pre-determined voltage used in metallic-arc welding can be held. The rate of electrode feed depends on welding current and the electrode melting rate, which has an important effect on the ultimate speed at which a good weld can be obtained.

Smooth travel is essential when working at the highest speed, as a disturbance of any of the welding conditions will result in a slower weld. Final reduction of the movement should be through a worm gear. The electrode best suited to the welding job should be selected, depending upon the qualities desired at the joint. The relative importance of strength, ductility and resistance to leakage or corrosion should be carefully weighed, as well as the design and heat-treatment of the joint and whether it is to be machined or ground. When two electrodes meet these conditions, select the faster one, which is the one with the highest melting rate.

In making a weld in abutting plates it is advantageous to increase the size of the electrode because less electrode material is removed. Larger diameter electrodes permit heavier currents, which increases the speed. Poor fitting joints are uneconomical for welding. Arc voltage is usually a measure of the arc length and a long arc generally produces a poor weld.

The three main costs in welding are labor, electrode cost and power. Economies in welding may be obtained through the application of the points in this analysis.—M. W. Brewster, *The Iron Age*, August.

The Secret of Ford's Low Costs

In the early days of the automotive industry a shop working on a small scale first made the engine, then the rear axle, and so on in sequence. Today every part is in progress at once. One of the reasons for the low costs of the Ford plant lies in the fact that all processes are going on simultaneously and in harmony.

An example of harmonious production in the Ford plant may be found in the use of jigs and fixtures. The time, both of the man and the machine, is utilized to the best advantage through the duplication of jigs and fixtures, allowing new set-ups to be made by the man while the machine is operating. Such simultation methods are followed throughout the plant with resultant economy. At any given time in the working day, every process used by the company is going on in harmony with every other process. The significant point lies in the words "in harmony," indicating a harmonious balance effected after all processes are going on at once. Such a balance within the Ford plant is responsible for the low price of its product.

With the advent of the new Ford Model A, this existing harmony of processes was temporarily upset by the moving and speeding up of the assembly line. Men had to be trained and machines speeded up to meet the demands of increased volume.

Volume without profits is one of the curses of large industry today. With lower costs there must always be a profit. "We regard a profit as the inevitable conclusion of work well done," states Mr. Ford. The fact should not be lost sight of that moderate profits in themselves are a source of lowered costs. Better methods increase profits and costs are again lowered. The cost of the new Ford product has been set low so that the large demand resulting from these low costs will produce large production, which in turn will produce the desired low cost. Ford anticipates a volume of vehicles to justify his low cost.—John Younger, *Manufacturing Industries*, June.

Metallurgical Requirements of Brass for Deep Drawing

The metallurgical requirements of brass for the deep drawing of shells may be roughly divided into chemical and physical. Among the chemical are the elements composing the brass, allowable variations of the constituents, and the amount of impurities. Among the physical requirements are plasticity, uniformity of structure, condition of surface, grain size, and absence of gas bubbles. The inclusion of gas bubbles is very undesirable because drawing will stretch them out into long thin cracks.

Maximum plasticity of brass at ordinary temperatures is obtained from the alloy which contains 30 per cent zinc, and the variation in zinc content should not be more than 2 per cent. Lead in quantities greater than 0.50 per cent is not permissible. When beyond 0.80 per cent in 70/30 brass, lead has a tendency to separate out at the grain boundaries. For this reason it is desirable to use electrolytic zinc. Tin as an alloying element is not desirable, as the elastic limit of the metal is raised and the amount of deformation is lowered. Aluminum in amounts greater than 0.10 per cent decreases the solubility of lead in brass, and is therefore not desirable. It also tends to form the oxide, which remains in the material as thin flakes to cause brittleness. Again a few hundreds of one per cent of sulphur and oxygen taken up from the combustion products are very harmful, as the brass becomes too brittle to be used for deep-drawing purposes.

To reduce the grain size, and consequently increase the strength that has been impaired by the drawing process, annealing is used. A too high annealing temperature causes the zinc to distil out of the brass so that it appears "burnt," and, on the other hand, a too low annealing temperature is uneconomical since the time required is too great. The best annealing temperature for brass to be used in the manufacture of deep-drawn shells is 1,210 deg. F., since at this temperature the maximum plasticity is obtained. The annealing time varies with the amount of cold working which has been done. Usually 1 to 2 hours is sufficient for complete softening.—Dr. James Silberstein, *Metal Stampings*, July.

IDEAS · FROM · PRACTICAL · MEN

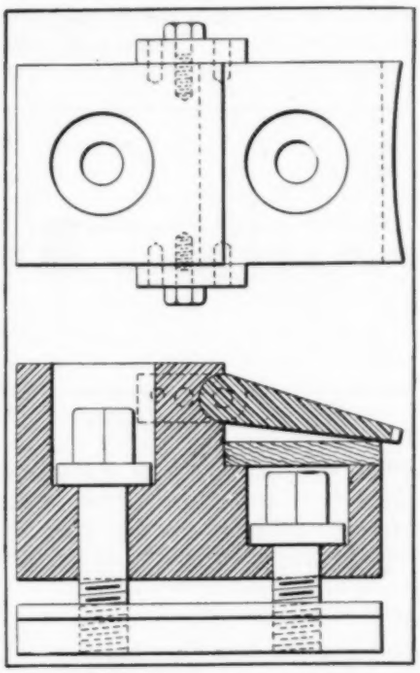
The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from a minimum of five dollars upwards, depending upon their merit

Hold-Downs Built Into Chuck Jaws

By F. E. Clarke

In holding work in a chuck or in a machine vise, it is sometimes difficult to get it to bear on the parallels. To overcome difficulty of this kind, we made a set of special jaws for the chuck of our vertical boring machine, one of which is shown in plan and section in the illustration.

The jaw is made from machinery steel, and in the upper part is a half-round groove in which the hold-down, made from a good grade of tough steel and hardened, is seated. In addition to being seated in the groove, the hold-down is held in place by pins in plates attached to both sides of the jaw. Its outer end rests on a wooden strip on the step of the jaw.



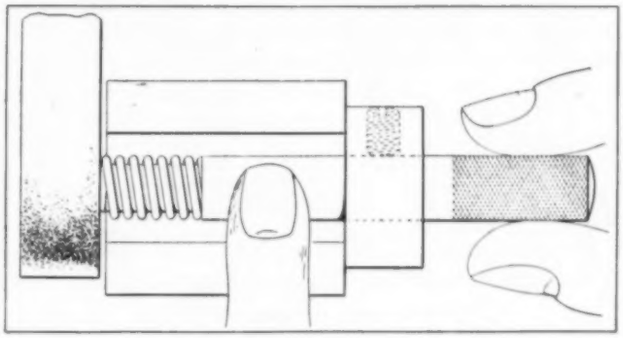
One of the chuck jaws equipped with a hold-down

When pressure is applied to the work the wooden strip gives sufficiently to allow the hold-down to force the work down on the parallels, and the greater the pressure the harder the work is forced down. Jaws fitted with these hold-downs have enabled us to get work in much better shape and in shorter time, as the old method of alternately tightening the jaws and driving the work down with a soft hammer, has been eliminated.

Grinding the Ends of Helical Springs—*Discussion*

By H. J. Gustav Kopsch

Referring to an article under the title given above, on page 787, Vol. 68, of the *American Machinist*, in which Charles Kugler describes a method of grinding the ends of helical springs, I wish to offer the following suggestion:



Device for grinding the ends of springs

If the springs to be ground are not uniform in diameter, it would be difficult to get the oversized ones into or out of the holes in the fixture described. Any springs that are undersize would be liable to spin around, or even to spring out and be caught between the wheel and the fixture, thus possibly causing wheel breakage. If the springs should spin around when grinding the first ends, the underground ends might make deep scratches in the face of the magnetic chuck.

A method I have used is shown in the illustration. The springs are mounted upon the turned-down end of a stud, on which they are a push fit. The stud slides in a V-block clamped to the grinder stand, being held in the V by the thumb of one hand while it is fed to the wheel by the thumb and one finger of the other hand. An adjustable collar limits the motion toward the wheel by contacting with the edge of the V-block. Twisting the stud while pressing the springs against the wheel will help to prevent drawing the tempers of the springs, and will also prevent the ends of the springs from digging grooves in the side of the wheel.

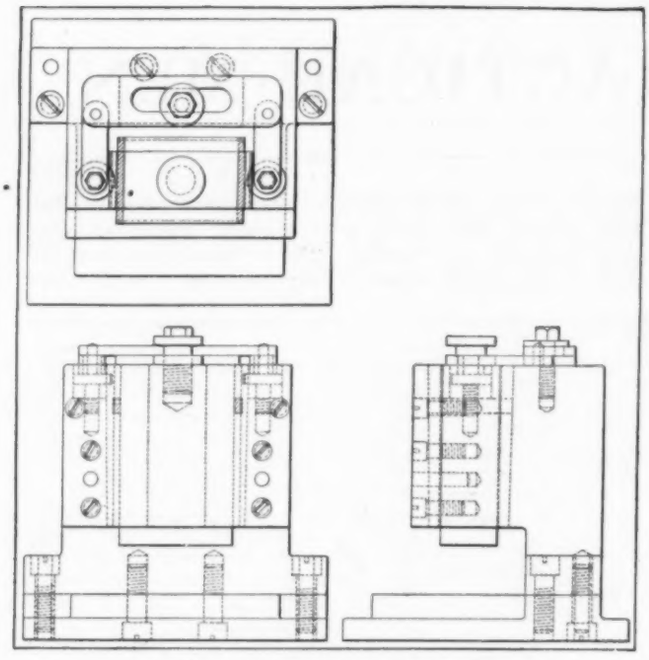
To prevent oversized springs from spinning on the stud when in contact with the wheel, the stud end could be threaded the same pitch as the springs. The springs could then be screwed onto the stud. However, I have never found this necessary.

Sub-Press With Rectangular Plunger

By G. R. Richards

The sub-press shown in the illustration has a rectangular plunger, and is so designed that when the gibs are adjusted for wear, the original alignment of the plunger will not be changed.

While the press illustrated is intended for use in blanking long pieces from narrow stock, fed through lengthwise, the design can be changed to provide a press



Sub-Press with rectangular plunger

for blanking short pieces from wide stock, fed through sidewise.

The four taper gibs are adjusted an equal amount by the turning of two screws by wrenches connected by a link. While the screws operate but two of the gibs directly, the other two gibs move in unison with the first two, because they are keyed to them.

On the heads of the adjusting screws are short socket-wrenches, both of which are connected by a link. When the link is moved in either direction, the wrenches must both move equally. Therefore, the screws must be moved an equal amount.

The link is slotted to allow endwise motion without interference from the clamping screw. If greater adjustment is required than is provided by the limited movement of the link, the wrenches can be removed from the screw heads and relocated so as to permit another partial rotation of the screws.

Making Erasures on Tracings *Discussion*

By A. Hermann

In an article under the title given above, on page 1017, Vol. 68, of the *American Machinist*, Harry Hoisington opposes the prohibition of steel knives for erasing, maintaining that tracers should be instructed to lean lightly on the ruling pen and then be taught how to use steel erasers correctly.

Unquestionably, lines inked in with a light touch are much easier to erase, but I do not believe that it is practical to educate apprentices to use razor blades and the like, because the few minutes saved do not offset the almost inevitable damage to the tracing cloth. Novices often spoil tracings by putting holes in them before they acquire the knack of erasing, and usually have graduated to the detailing class before they are proficient scrapers. Even skillful tracers, who take off the easily-removed top ink with a knife and finish up with an abrasiveless rubber, occasionally tear the finely woven fabric of the tracing cloth in an attempt to take out lines, especially the ones that have soaked into old tracings. Soapstone, powdered talc and other agents are then resorted to in order to obtain a smooth base for reinking, whereas the soft eraser would have left a polished surface if it had been used from the beginning.

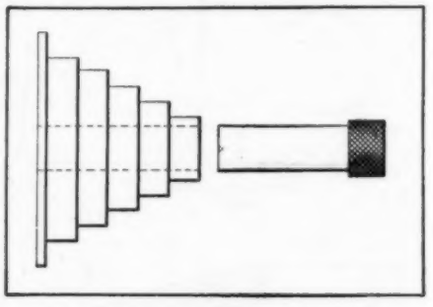
In view of the fact that the time saved amounts to so little, and considering that the soft rubber is used finally anyway, I favor an inflexible ban on metal erasers, particularly when several tracers are employed. To preserve the morale, no one should be privileged to use the knife. While the expert may suffer a trifle under this rule, in the long run, the company will save both time and tracings.

A Stepped Centering Plug

By E. L. Sleppy

When it is necessary to scribe a circle or an arc from the center of a hole already drilled, the hole must be plugged and the center found on which to rest one of the divider points. Of course, if the hole is very small, dividers having a ball on the end of one leg can be used, eliminating the necessity of plugging the hole.

For such work, however, I have made the stepped plug shown in the illustration, which for lightness is made of aluminum. The steps vary from $\frac{1}{4}$ to $\frac{3}{4}$ in. in diameter and are $\frac{1}{8}$ in. in width. A pin, knurled on one end and having a prick-punch mark in the center of the other end, is a push fit in the central hole.



Stepped centering plug

When the hole around which the circle or arc is to be scribed is filled by one of the steps of the plug, the pin is inserted in the central hole a distance to bring the end level with the face of the work, so that with one of the divider points in the prick-punch mark, both points will be practically in the same plane.

Adjustable Spacer for the Lathe Chuck—*Discussion*

By Henry Simon
Jena, Germany

On page 631, Vol. 68, of the *American Machinist*, Charles Kugler, in an article under the title given above, discusses a device described by me on page 986, Vol. 67, of the same journal, and proposes two devices of his own. As will be seen, one of these consists in the use of three bolts clamped to the face of the chuck, while the other involves the use of three slotted and adjustable blocks, also fastened to the chuck face by means of screws.

Both of these devices are without doubt serviceable and should prove useful, especially for some kinds of large and irregular work. Mr. Kugler, however, makes the mistake of allowing his enthusiasm to carry him too far, when he says that "Either of these devices will

answer every purpose of the one shown by Mr. Simon, and they have the advantage of being much cheaper."

By means of the three bolts, it is possible to block only parts considerably larger in diameter than the hole through the chuck. It is particularly work *smaller* than the hole through the chuck which needs the block, however, because such work must be held by the plain parts of the jaws, whereas a great deal of the larger work can be raised enough by reversing the jaws and using the steps. At least half of the average work held in the chuck is of the smaller diameter and many chucks do not have the necessary intermediate slots. Mr. Kugler's three bolts will not "answer every purpose," but will fall short of being applicable in about 90 per cent of all cases.

As against this, the second device of three adjustable blocks can, without doubt, be made to handle smaller work. How Mr. Kugler arrives at the impression that these three spacers, each requiring nearly as much work as my one, and calling, besides, for three capscrews and washers, and three holes to be made in the face of the chuck, "have the advantage of being much cheaper," seems beyond explanation.

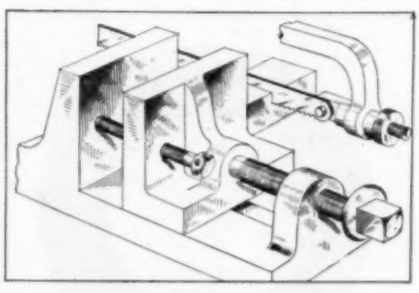
Certainly I will undertake to produce two of my spacers, complete, at the same expense as for one set of Mr. Kugler's. Even then I will have a single self-contained article that can be instantly put in place and removed without further ado, while Mr. Kugler, with his bolts and washers, will have nine parts to look out for, to screw in place, adjust, and to unscrew after he is done. Also, he will have three additional dirt and chip catchers in the face of his chuck, in the shape of three tapped holes that will hardly serve any useful purpose other than the one for which they were intended.

The main advantage of Mr. Kugler's devices is that he is able to face the screws off after they are in place. It is easy, however, to set the screws of any device by means of a micrometer close enough for almost any practical purpose. As against this single advantage, the one-piece design, quick action, and three-line surface support of any device is certain to render it more advantageous to use in the majority of average work, either in the shop or the toolroom.

Equalizing the Grip of a Machine Vise

By Chas. H. Willey

The illustration shows a very handy little kink for use on a power hacksaw for equalizing the grip of the jaws on short pieces of stock, saving the time for hunting up



Screw for equalizing the grip of a machine vise

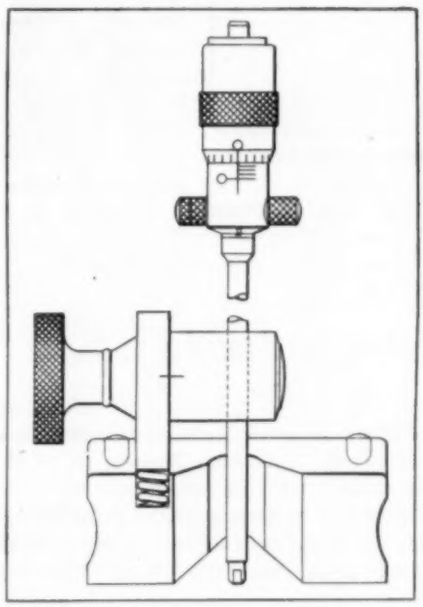
blocking for the jaws to make them grip evenly. A long hex-head screw is put through the movable jaw of the vise, on the side farthest from the saw. Where a short piece of stock is to be cut off, the screw is adjusted so that its end will contact with the stationary jaw of the vise when the jaws are at clamping distance. This stunt has saved not only time, but many blades, for it stops the take-a-chance fellow who would try to hold a short piece without blocking the jaws at a point beyond the inner end of the work.

Surface Gage Converted Into a Height Gage

By George C. Warren

The sketch shows how a Starrett surface gage was converted so that it would serve as a height gage.

The only new parts to be made were the clamping stud and sleeve. When these parts were made they were drilled and reamed in place, the hole being of a size that all of the spindles of my inside micrometer would fit nicely. The clamp bracket was rendered non-adjustable by screwing it down tightly.



Height gage made from a surface gage

With the longest micrometer spindle in place and set square vertically, a line was scribed across the junction of the clamping bracket and the sleeve. In changing or replacing micrometers, when both parts of the line coincide, any micrometer that is in the gage is in a vertical position, accurately enough for all intents and purposes.

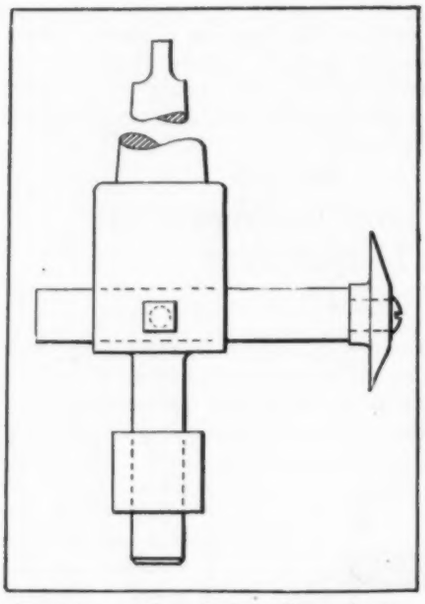
By removing the new clamping stud and its sleeve, and putting the original ones in place, the post and the indicator of the surface gage can be replaced. When these parts are in place and the clamping bracket is loosened, the tool again becomes a surface gage. Thus by the addition of two small parts, my one tool answers the purpose of two.

Tool for Cutting Cloth Buffing-Wheels

By Geo. W. Wilson

We use a great many cloth buffing-wheels in our polishing department. The wheels are about 1 in. thick, and when new are 12 in. in diameter. After they have become worn so that they are too small for a particular operation, they are cut down to about 6 in. in diameter to suit another operation on a different piece.

Some trouble was experienced in cutting down the wheels to the smaller diameter. After experimenting with different kinds of tools, we made the one shown in the illustration. The body is provided with an adjustable cross-arm, carrying on one end a hardened cutter in the form of a disk. The bushing on the lower end of the



Tool for cutting cloth buffing wheels

body is a tight push fit in the bore of the buffing wheel.

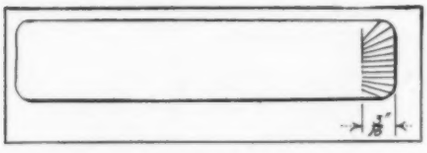
In operation, the tool is used in the drill press. The buffing wheel is laid on its side on a board provided with several sharp spurs to prevent it from turning under the rotative pressure of the cut. After cutting in from one side about to the center, the wheel is turned over and the cutting is completed, from the side now uppermost. Running at a comparatively high speed, the tool will trim a wheel in a very short time and make a first-class job of it.

A Help in Erasing

By S. Udo

Draftsmen and clerks who have occasion to make frequent erasures will find the following suggestion to be quite a help: Take an ordinary ink eraser and cut slits in the end with a penknife, as shown in the illustration.

With the tracing, or letter, as the case may be, laid on glass, erase in the usual manner. A glass-topped



How the eraser is to be slit

desk presents an ideal surface for the work, though if one is not at hand, a celluloid triangle will make a good substitute.

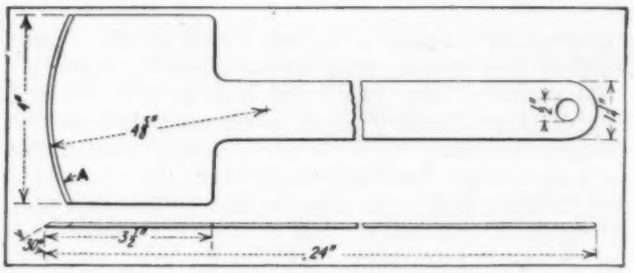
With the eraser cut as shown, the erasing can be done in half the time taken to do it in the ordinary way, and the job will be better done. The tracing, or letter will not be scratched, and corrections can be made without danger of the ink running.

Paddle for Use in Making Erasures on Tracings

By J. E. Fenno

The sketch shows a very useful addition to the draftsman's toolkit. It is a celluloid paddle and is used when making ink erasures on large tracings. In use, the paddle is slipped beneath the tracing cloth under the part to be erased and forms a smooth, hard surface for the knife or the eraser to bear upon.

While a celluloid triangle could be used for the purpose, there is no easy way of shifting it about when



A useful tool for the draftsman

making erasures near the middle of a large tracing. The long handle of the paddle, which will protrude beyond the edge of the tracing, provides a means of shifting the paddle wherever necessary without untacking any part of the tracing cloth. The curved edge *A* is beveled to make it easy to slip the paddle under the edge of the tracing.

How the Disks for a Metal-Edge Filter Were Made

By H. C. Deckard
White Motor Car Company

In perfecting a metal-edge filter for filtering switch and turbine oils, we ran into difficulties in the production of the filtering disks. Each filtering member consists of a square tube 39 in. long on which brass disks 0.00025 in. thick are strung. A complete filter contains a number of the tubes, ranging from 6 to 24, according to its capacity.

After considerable experimenting, the disks were made by the following process: Brass stock, 6 in. wide and 0.00025 in. thick was cleaned, dried and wound on reels.

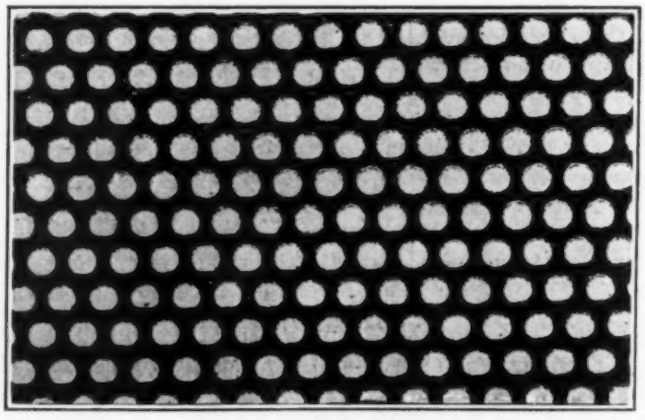


Fig. 1—The stock as it comes from the printing press

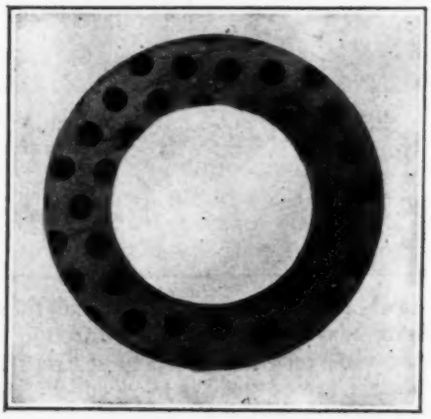


Fig. 2—One of the disks punched from the copper-plated stock

It was then put through a special printing press in which a special ink that would dry quickly and that would resist a plating bath, was used. The back of the stock was covered with ink, with the exception of a space of $\frac{1}{8}$ in. at each edge. The other side was printed in a design which left the brass exposed in a series of small dots, as shown in Fig. 1, and in a strip $\frac{1}{8}$ in. wide at each edge.

After the stock had passed through the printing press, it was festooned on a long rack to dry. The drying took from 10 to 24 hr., depending upon the humidity of the atmosphere. It was then put through a plating bath where the exposed metal in the dots and at the edges was coated with copper to a thickness of 0.00025 in., the plating solution being kept in constant agitation by means of a pump.

The speed of the stock through the plating solution was determined by the time required to secure the proper thickness of the deposited metal, at a certain controlled amount of current. The exposed metal at the edges was used to secure electrical contact for plating.

Succeeding the plating operation, the stock was cleaned to remove the ink. It was then put through a punch press where the disks, shown in Fig. 2, were blanked at the rate of 360 per min. in a progressive die that cut three disks at each stroke of the press.

Each filtering member contains approximately 13,000 disks, so that there would be 312,000 disks in a filter containing 24 members. In filtering, the oil is forced between the disks by air pressure, removing all dirt, sludge and other forms of foreign matter. The space through which the oil must pass is 0.00025 in., being controlled by the thickness of the copper plating on the dots. In cleaning the filter, the oil is back washed, under pressure, between the washers. In Fig. 3, is a sectional view of a a brass ring, as is shown in the upper right-hand corner.

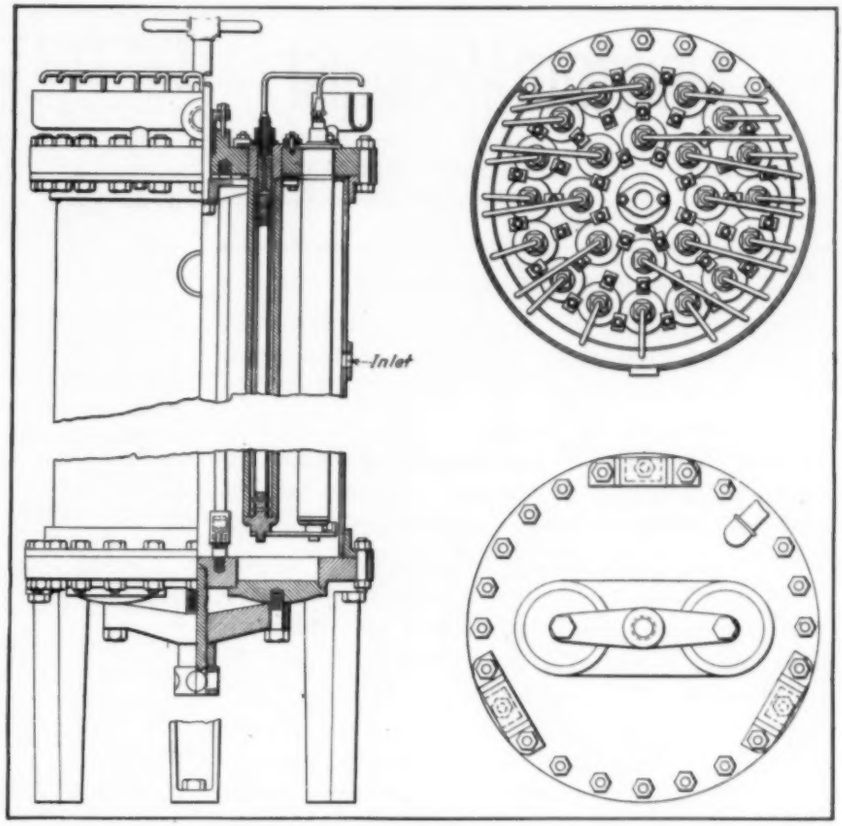


Fig. 3—Sectional view of a filter containing 24 filtering members

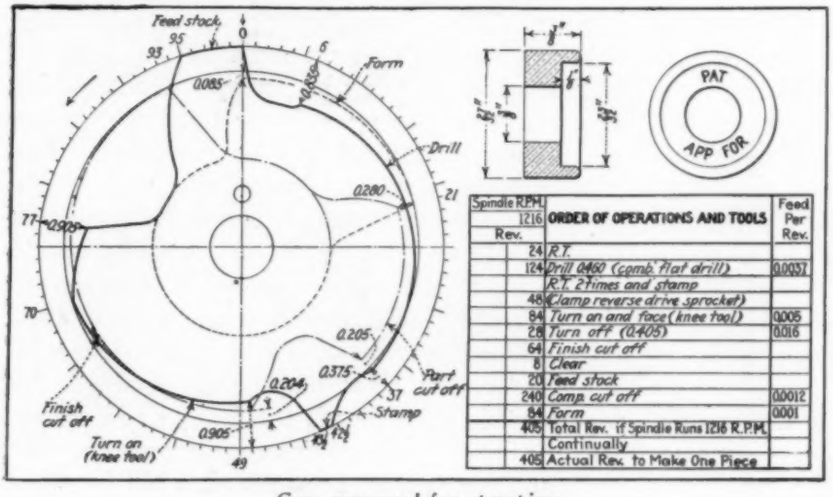
Stamping in the Screw Machine

By Ernest C. Allen

The drawing illustrates a method of performing on a Brown & Sharpe automatic screw machine, an operation that would ordinarily be done on a punch press. The words, "Pat. App. For" are stamped on the shoulder of a brass ring, as is shown in the upper right-hand corner.

The operation is accomplished by taking advantage of the forward throw of the turret during indexing. It will be noticed that the length of the cam lobe marked "Stamp," is only 1/100 of the cam circumference and has no rise. The turret, when indexed, moves back, withdrawing the drill. At the back end of the stroke, the actual indexing takes place. The stamping tool, consisting of an ordinary steel stamp mounted in a float holder, is thereby brought in line with the work, which has been stopped, by reversing with the reverse-drive sprocket clamped. The turret then moves forward.

The dogs are adjusted to cause the roll to come down on the lobe marked "Stamp." The stamp strikes the work and the turret is immediately indexed, again bringing the stamp clear of the work. With proper adjustment, the turret can be made to strike a surprisingly quick, hard blow. A light facing cut over the letters will remove the burrs and improve their appearance.



Spindle R.P.M. 1216 Rev.	ORDER OF OPERATIONS AND TOOLS	Feed Per Rev.
24	R.T.	
124	Drill 0.460 (comb. flat drill)	0.0057
	R.T. 2 times and stamp	
48	Clamp reverse drive sprocket)	
84	Turn on and face (knee tool)	0.005
28	Turn off (0.405)	0.016
64	Finish cut off	
8	Clear	
20	Feed stock	
240	Comp. cut off	0.0012
84	Form	0.001
405	Total Rev. if Spindle Runs 1216 R.P.M. Continually	
405	Actual Rev. to Make One Piece	

Cam arranged for stamping

American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

Established 1877

Equality of Opportunity

"EQUALITY of opportunity is the right of every American—rich or poor, foreign or native-born, irrespective of race or color." In that sentence of his acceptance speech Herbert Hoover expressed the fundamental difference between philosophies of the old and new worlds.

To the average "100-per cent" American whose acquaintance with old-world problems is limited to what he may happen to read, or see on a newsreel screen, the principle of equal opportunity is axiomatic. He takes it for granted as he does the telephone and the coming of the morning newspaper. What he does not realize is that this principle is almost exclusively American, that in very few other countries is there anything approximating equality of opportunity. In Europe, particularly, class distinctions are quite clearly drawn, both socially and educationally. It is not impossible, of course, to break through the barriers, but it is extremely difficult.

Here we have no such handicap and it is a matter for congratulation that in November we shall have the chance of considering for the highest honor in the land a man who is so strongly imbued with the vital importance of the principle of equal opportunity and who is so earnest about seeing it preserved.

Machinery Markets in the Airplane Industry

THOSE who have been skeptical as to the possibility of the airplane industy becoming an important market for machine equipment are beginning to alter their opinions. The constant and rapid growth of airplane manufacture during the past year, largely stimulated by the great flights of Col. Lindbergh and others, has been greater than even its most ardent advocates imagined possible. The demand for reliable engines of various sizes has absorbed all the available capacity and encouraged the starting of a number of new plants, as well as the enlargement of those already established.

Only those who have followed this phase of aviation realize the extent to which new machine equipment has been purchased, or the expansion that is planned for the very near future. It is safe to say that a goodly portion of the increase of this year's business over that of 1927 has been due to aviation activity.

Nor is the use of machine equipment confined to the engine, for wooden construction in the plane itself has largely disappeared, except for wing spars and ribs. Even there wood is being largely replaced by metal, steel or duralumin, especially for fuselage and wing structures. All these parts require metal-forming, cutting, drilling and riveting machinery, not forgetting the welding equipment or the large number of fixtures necessary.

Machine dealers in centers where airplanes or engines are being manufactured have already found a market for more machine equipment than was dreamed of a few years ago. They are realizing that the work of the *American Machinist* over a long period, in stressing the future of aviation, is bearing fruit and that its predictions regarding future markets for machinery are coming true.

Have Engineers Ethics?

IF A man wants a house built he gets an architect to draw up sketches, and he must pay for the drawings and advice whether or not he decides to use them. If he then thinks another architect will plan a house at a little better price, the latter will not take up the work until the prospective customer has settled with the first architect and withdrawn gracefully. It is not professional ethics among architects to do so. But how does the engineer act under similar circumstances?

A man or firm comes to a contract shop with a set of dies or a special machine to be built. The chief engineer spends a day laying out the work, and as his staff goes along with the estimating they suggest ways and means. Finally the price is given. Then the customer grabs a train to the next city, and with his accumulated knowledge of methods and materials he prompts another chief engineer into offering a lower bid. Sometimes the process is repeated four or five times. The first engineer hears no more of the job, and his time is charged to overhead, eventually getting to the bills of other customers. Eventually, too, it is one of the reasons why four out of five contract shops have industrial pyorrhea and go out of business inside of ten years. There is no reason why a customer should not shop around and get the best possible price, but is there any good reason why the firm that makes a proposition and reveals ways and means should not submit a bill for engineering service?

Hall-Will "Super Six" Pipe Threading Machine

PIPE, in sizes from 1¼ to 6 in., may be threaded and cut off on the "Super Six" machine which has been placed on the market by Hall-Will, Inc., Erie, Pa. Rotative speeds vary from 59 to 12 r.p.m. The cutting-off speed for 6-in. pipe is 102 ft. per min. According to the manufacturer, speed changes from cutting off to threading may be made in 5 sec. This action is effected through the use of a single lever.

As will be noted in Figs. 1 and 2, the machine is sturdily constructed. The base is a heavy casting having an oil reservoir in the central portion and a recess at both ends. In the left-hand recess is mounted the 5-hp. motor for driving the machine. In Fig. 2, the removable chip bucket mounted on wheels is discernable in the opening provided for it. Reverting to Fig. 1, it will be noted that the left-hand chuck is of the three-jaw universal type, operated by a chuck wrench, while that at the right is of the same type but lever operated. The diehead carriage is traversed along the ways by means of the capstan wheel.

The proper threading speed for each size of pipe is readily selected at the dial shown in Fig. 1. The lever is self-locking in each position. It is not necessary to bring the machine to a dead stop to change speeds Starting, reversing, and stopping of the motor is readily effected at the push-button station mounted below the speed-selection dial. Shifting of the long lever at the left of the dial plate engages the clutch.

The machine is equipped with a patented diehead including an automatic gage that automatically gages the length of thread from the end of the pipe. The dies are ⅛ in. wider than the longest thread, thus permitting the cutting of full width threads under all conditions. The gage is permanently set for all diameters, but is adjustable for cutting a thread longer or shorter than standard. It is equipped with a visible thread length indicator located on the outside diameter of head directly in front of the operator. An emergency handle makes possible the tripping of the gage by hand when not required. At cut off, the gage lifts clear automatically.

The diehead carries five holders for

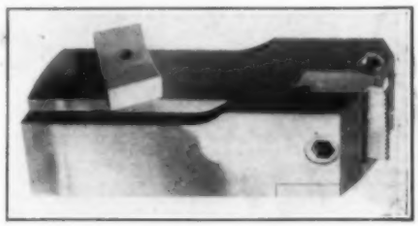
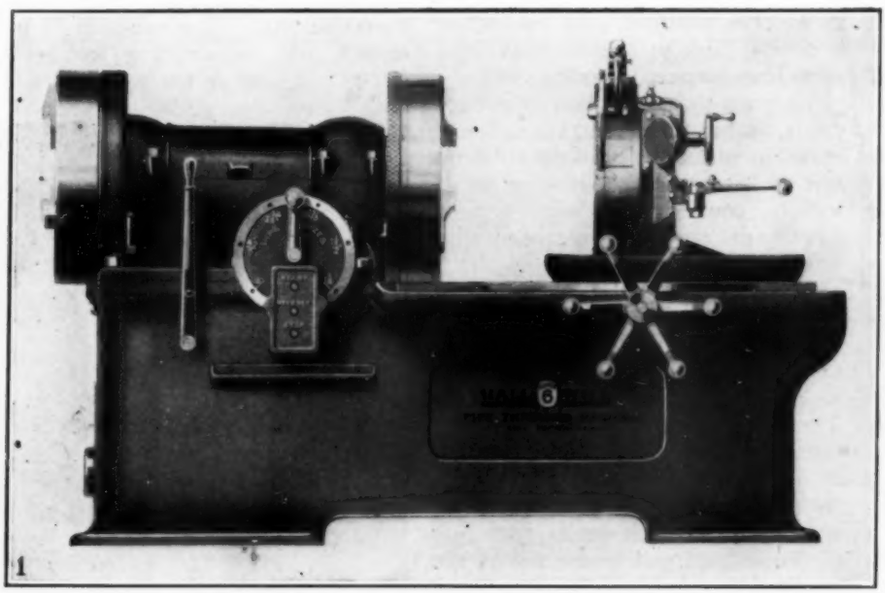


Fig. 3—Double-ended chaser mounted in holder

chaser bits. As shown in Fig. 3, these bits are double-ended, and fit into wide slots in the holders. Ample clearance for chips is given by lips of extra length. The bits are made of high-speed steel. The holders are made of high-carbon steel, ground all over, and special circular gibs keep them in the proper position in the head. A large bronze shoe is fitted into each holder, and engages with the control cam. The shoes can be removed quickly. The adjustment of the head for various sizes of pipe is taken care of by a large segment cast solidly in the operating cam. It is only necessary to slack off the nut, and the head can be set to whatever size is required. Markings on the head and cam give the proper position for cutting standard threads.

The diehead is a separate unit from the stationary head to which it is bolted. The stationary head has large V-blocks for setting the pipe



1

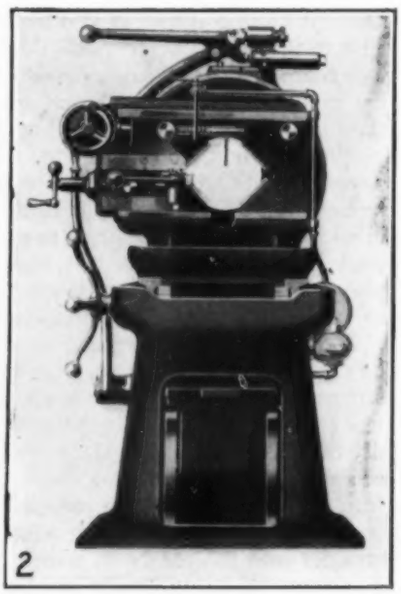


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Fig. 1—Front view of the Hall-Will "Super Six" Pipe Threading Machine
Fig. 2—End view showing the V-blocks and cutting-off blocks

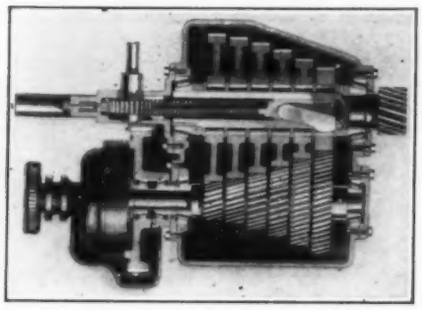


Fig. 4—Gear box in the Hall-Will "Super Six" Pipe Threading Machine showing the helical gear drive

and these run on long V-shaped bearings, gibbed in place. This construction insures the head and V-blocks being held square against the rear of the stationary head, and prevents the cut-off block and tools from weaving. These blocks are equipped with large phosphor-bronze nuts to take the stress and wear of the screws. Hardened, interchangeable tool-steel plates are fitted into the faces of the V-blocks to take the stress and wear from the pipe. The handwheel for operating the blocks is set parallel with the face of the machine.

An extra long, cast-steel cut-off block fitted with wide V-bearings and phosphor-bronze nuts is included. The screw on this block is fitted with a ball thrust bearing. The cut-off has a double-beveled high-speed steel blade. A high-speed steel bit is also used in the reamer, which is of the swivel type with ball handle. An outside chamfering device is also located next to the cut-off blade. This double tool chamfers the outside diameter of the pipe after the cut off and gives the dies a good start on the thread.

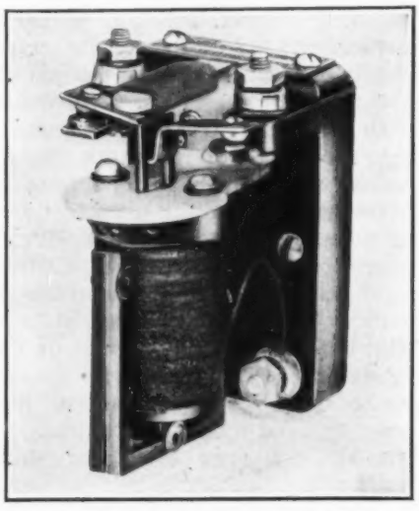
The gear box, shown in Fig. 4, is a separate unit, and has the two shafts mounted on Timken bearings running in oil. Helical gears are used to eliminate vibration and noise. A removable cover plate permits the operator to open up the box for inspection.

Cooling of the dies is accomplished by the use of a high-pressure fan-type stream of coolant with adjustable control from four ports. The position of delivery can be changed if found desirable The coolant and chips fall into the chip box from which the coolant is drained off through a strainer into the reservoir, which has a capacity of 25 gal. The self-priming coolant pump is driven direct from the drive shaft.

General Electric Warning Signal Relay

Designed for application where a small device is needed to actuate a warning signal, when power fails or voltage drops on an important circuit, this relay has been introduced by the General Electric Company, Schenectady, N. Y. It is known as type CR-2904-F-1. As shown in the illustration, it is compactly designed.

In operation, the coil circuit of the relay is connected across the two legs of the power supply, which it is desired to watch. When the coil is thus energized, the relay contacts are held



General Electric Warning Signal Relay

in an open position. By connecting a circuit through the contacts to a signalling device, warning will be given when the power fails or voltage drops, and in that event, the coil will be de-energized, the contacts will close and the circuit to the warning signal will be completed. Either a.c. or d.c. circuits can be taken care of with this relay.

The device is of the solenoid type, having a laminated armature of three sections, the central leg being fastened to a Bakelite operating arm which raises and lowers the contact tips. The unit is mounted on a molded compound base, $1\frac{7}{8}$ in. wide and $2\frac{1}{2}$ in. high, and is furnished together with a small enameled tube resistor, the rating of which varies according to the voltage and frequency of the application. A panel mounting type can also be supplied.

When used as a voltage-drop warning device, adjustment to the proper operating voltage is made by means of an adjustable brass screw protruding into the air gap, over the outside leg of the armature. Thus a fine adjustment of pick-up and drop-out may be obtained. In actual tests, the relay was made to drop out at 106 volts, after picking up at 112 volts, or at 95 per cent of the pick-up voltage.

Peerless "Man Cooler" Portable Electric Fan

For use where men are working on hot or dusty jobs, this "Man Cooler" has been introduced by the Peerless Electric Company, Warren, Ohio. The unit is recommended for use in steel mills, and enameling, japanning, and heat-treating plants. It consists of an electric fan unit mounted upon a swiveling standard. This standard is supported by a cast-iron pedestal, 20 in. in diam., and weighing 65 pounds. The heavy base prevents tipping of the unit.

The fan is 18 in. in diam., and has fifteen steel blades imparting a velocity of 1,400 ft. per min., to the air when running at 1,150 r.p.m. It is driven by a $\frac{1}{4}$-hp. single-phase, 60-cycle, 110- or 220-volt motor. S.K.F. ball bearings are used in the motor. The fan is protected by a heavy-gage mesh screen, and an angle-iron frame protects the motor. The unit is supplied with 20 ft. of special rubber covered "Flex-o-cord" with non-breakable plug. The height is 57 in. overall, and the shipping weight is 490 lb. A snap switch is included.

Peerless "Man Cooler" Portable Electric Fan

"Fuzon" Series R Arc Welders

IMPROVED appearance over previous models is a feature of this line of series R arc welders manufactured by the Fusion Welding Corporation, 103rd St. and Torrence Ave., Chicago, Ill. Several features common to previous designs have been retained. Among them are the use of an interpole arrangement by which turns of the commutating coils are extended to the main pole flanges to form a stabilizer; an auxiliary set of brushes on the main commutator so that a single control of the current over the full range is possible; and the use of ball bearings to support the generator shaft. These machines are made in portable and stationary models, of the motor-generator type, and also a gas-engine-driven unit in both portable and stationary models. In Fig. 1 is shown a portable motor-generator arc welder, while in Fig. 2 a gas-engine-driven unit is shown.

The motor-generator units are made in sizes having capacities of 200, 300 and 400 amp. The welding range is 50 to 300 amp., 70 to 400 amp., and 100 to 600 amp., respectively. The starter used on all machines is of the push-button type with automatic overload kick-out switch. All sizes are equipped with a Weston voltmeter and an ammeter. For metallic arc welding the motors used are 10, 15 and 20 hp., respectively. Both the portable and stationary models have the same lengths and widths. The dimensions vary from 41x21 in. to 70x25 in. for the smallest and largest sizes respectively. The weights for the portable sets are 1,080, 1,375 and 1,600 lb., respectively.

The gas-engine-driven units are built in capacities of 200 and 300 amp. The smaller size is driven by a Continental "Red Seal" motor running at 1,450 r.p.m., and having 23 brake hp. The larger size is driven by a motor having 40 brake hp. An automatic governor keeps the engine speed constant. The lengths, widths and heights of the two models are 68x30x60 in., and 72x30x63 in. for the portable type. The weights for the portable type are 1,550 and 1,910 pounds.

"Supreme" and "Jumbo" Casters

These casters made in swivel and rigid types are intended for heavy-duty service. They are manufactured by the Saginaw Stamping and Tool Company, Saginaw, Mich. The "Supreme" caster shown in Figs. 1 and 3 is made of pressed steel, and has a ball bearing swivel. The roller bearing axle is caged in hardened bushings and thrust washers. Hardened chrome-nickel steel rollers are

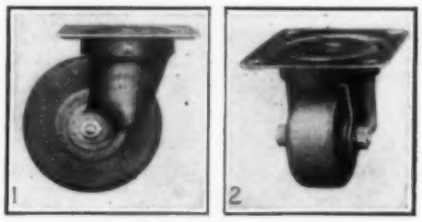


Fig. 1—Saginaw "Supreme" Roller Bearing Caster. Fig. 2—"Jumbo" Plain Bearing Caster

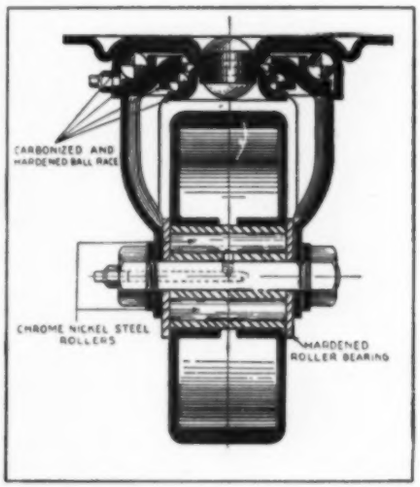


Fig. 3—"Supreme" Swivel Caster shown in section

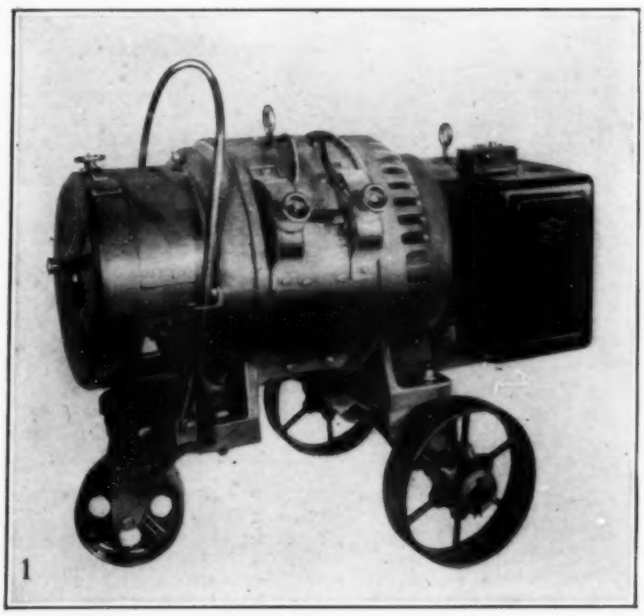


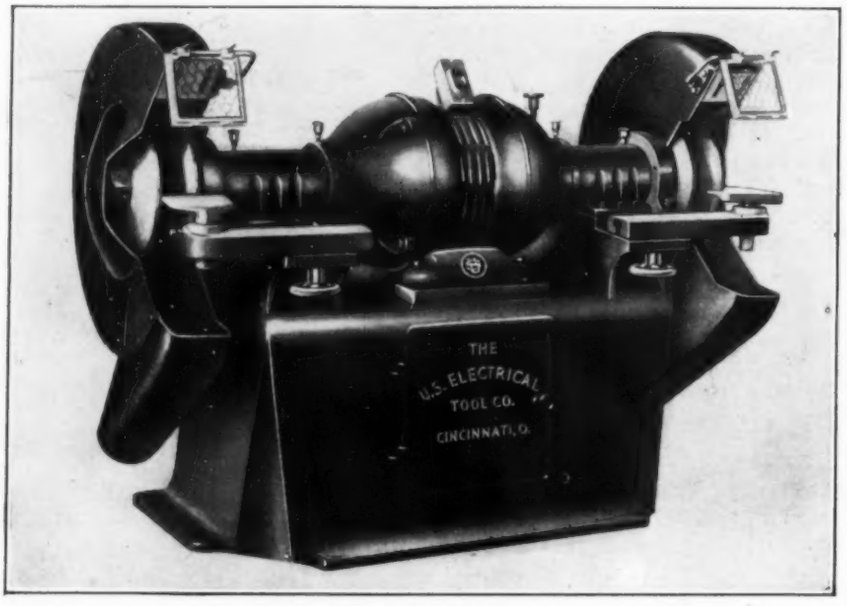
Fig. 1—"Fuzon" Portable Motor-Generator Arc Welder. Fig. 2—"Fuzon" Gas-Engine-Driven Arc Welder

used. The "Supreme" will withstand loads up to 1,500 lb. per wheel. It is made in 4-, 5- and 6-in. wheel diameters, all with 2-in. faces. This caster may be equipped with Zerk fittings to lubricate the swivel.

The "Jumbo" caster shown in Fig. 2 is similar to the "Supreme." It also has rounded edges on the wheel, but it has plain bearings. It is made in 3-, 4-, 5-, and 6-in. wheel sizes. The 3-in. size is made in 1½-in. face, all the rest being 2 in. The 3-in. wheel will withstand loads of 400 lb., while the larger sizes are recommended for loads up to 1,000 pounds.

"U. S. Hispeed" Grinder

HIGH wheel speed is a feature of this large grinding and snagging machine which has been introduced by the United States Electrical Tool Company, Cincinnati, Ohio. A speed of 9,500 ft. per min. is obtained when wheels 30 in. in diam. having 2½-in. face and an 18-in. arbor hole, are operated from 40- or 60-cycle circuits. When these wheels are worn down to 24 in. in diam., the wheel speed is 7,500 f.p.m. For 25- and 50-cycle circuits, 24-in. wheels with 2½- or 3-in. face and 12-in. arbor holes are recommended, giving 9,200 f.p.m. The machines for these frequencies are furnished to operate on 220-, 440-, and 550-volts, 2- or 3-phase a.c., and 220-volt d.c. circuits. The motor has a rating of 15 hp., and is designed for heavy-duty grinding. It is rated for a temperature rise of 40 deg., and with a momentary overload capacity of 100 per cent.

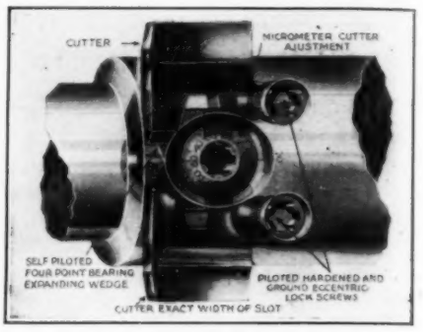


"U. S. Hispeed" Grinder

The "U. S. Hispeed" grinder has the wheel flanges keyed to the shaft, and securely clamped to the wheel by cap screws. Structural steel safety hoods over the wheels are designed for speeds of 10,000 f.p.m., and the doors on the safety hoods are fastened with cap screws. The double-ended shaft is made of nickel steel, and mounted on four heavy-duty ball bearings in dustproof housings.

Davis Improved Type L Expansion Boring Tool

This boring bar is being manufactured by the Davis Boring Bar Company, Division of the Larkin Packer Company, 6200 Maple Ave., St. Louis, Mo. The tool was formerly made by the Larkin concern. It was previously described as the "Larkin Expansion Boring Bar" on page 438, Vol. 68, of the *American Machinist*. Refinements include the use of socket-head cap screws of standard type, and cutter slots taking cutters interchangeable into the bar slots of the old style Davis expansion boring tool. The micrometer adjusting screw is plainly shown in the phantom view above.


CUTTER
MICROMETER CUTTER ADJUSTMENT
SELF PILOTED FOUR POINT BEARING EXPANDING WEDGE
PILOTED HARDENED AND GROUND ECCENTRIC LOCK SCREWS
CUTTER EXACT WIDTH OF SLOT

Davis Improved Type L Expansion Boring Tool

Mahan Centrifugal Wire Stripper

The centrifugal wire stripper developed by C. B. Mahan, 162 Longview Terrace, Rochester, N. Y., has been sold by him to the Webber Machine Corporation, 33 South Water St., Rochester, N. Y. The machine was described on page 791, Vol. 68, of the *American Machinist*.

Trade Catalogs

LIGHTING FIXTURES. The O. C. White Co., 15 Hermon St., Worcester, Mass., has published Bulletin E-328, showing various types of lighting fixtures for factory, office and display lighting. These fixtures are equipped with a special daylight lens and are made in various finishes. Each type is illustrated.

SHELL END MILLS. The Goddard & Goddard Co., Detroit, Mich. has issued a catalog showing shell end mills conforming to the standards set by the Simplified Practice Committee on Milling Cutters. Shell end mill arbors, collet holders, and collets are also described and illustrated. Dimension tables show the sizes in which the tools can be obtained. Several sizes of each have been added to the line to make previous sizes interchangeable with those corresponding to the new standards.

SLITTING AND COILING MACHINES. The Torrington Manufacturing Co., Torrington, Conn., has issued a leaflet showing the No. 581 slitting machine and the No. 1117 coiling machine. The capacities and general design of these units are given.

NEWS OF THE WEEK

Optimism Prevails in France Due to Improved Industrial Conditions

American machine tool market awaits development

By Our Paris Correspondent

UNQUESTIONABLY general industrial conditions have improved here, at least prospectively. The labor market indicates that there are few unemployed in the metal working trades, even in the usually overcharged Paris district, where the bulk of French industrial plants is located. It is perhaps too much to expect that a trade boom will materialize in the fall, but it is more than likely that purchasing ability will manifest itself in the near future in many quarters where conditions have been static for the past months. This, at least, is the optimistic hope and belief.

At the same time, while there is little indication that the price of manufactured goods will rise inordinately, it is a fact that the stabilization of the franc has brought about a rise in living costs. The index for the second quarter of the year has increased to 544 as against 521 for the preceding quarter, or nearly 4 per cent. It is, however, only the small wage earner who is likely to feel this. The middle class and higher wage scale elements are likely enough to start a buying campaign to the limit of their resources the moment the adjustment period has been passed.

Automotive Production Index

It may be mentioned that, taking the automobile industry as a barometer, plans for the 1929 output indicate optimism beyond that believed possible even before the war. Much depends in this line on the state of the export market and American competition, which will have to be met in the world-wide field, but at least one French maker is counting on increasing his output 30 per cent or more, a feat that is only possible by his having improved his productive equipment by the installation of super-machinery and a genuinely scientific management and control. If others in France are to keep pace, they will have to adopt the same methods and lessons that this maker learned from American practice.

The General Syndicate of Industrial Engineers, through its secretary, Mr. Dubois, has gone on record with a severe criticism of standardization and the American application thereof. He cast rather a shadow over the possibility of such methods ever being carried out widely in France. It is without question that many French engineers and specialists see in standardization and intense application of scientific organization a scheme whereby the employer, by the bait of high salaries, will demand more than human forces can give without draining the workers' energies to a dangerous degree. When that time comes, the worker will be supplemented simply by other new comers who can stand the strain. The point of view is, of course, not logical when all the elements are taken into consideration, but it apparently exists to some degree.

Reports from distributors of American machine tools in this market indicate that they have all increased their business since the first of the year. The demand for efficient, high-production American machines is becoming more apparent from day to day in spite of competition from those of England and Germany or even of French manufacture of more limited capacities, and of course of lower price.

American Machine Tool Builders Handicapped

There are handicaps that exist here which many American makers and exporters do not seem to know exist, or at least do not fully recognize their importance. Briefly, customs dues apart, there is the handicap of high freight charges by reason of the long rail hauls in America to tidewater and the high ocean freights to follow; there is the increased charge of more costly boxing and crating (though this should not be skimped), and there is the comparative facility, which often does not apply to the American machine a long way from home, of having the English or German representative close at hand to demonstrate or install the machine itself. Those American makers who have followed the latter plan have found it pays; more should do the same if they expect to increase sales.

Aside from the protection that the French government gives to the French-made machine, there is also to be considered the encouragement which it tacitly, or by implication, gives to the French plant to install German machinery to be had on reparations account. This of course affects British machinery imports into France as well as those of America. But both British and German machines, with their accessibility, their lower freights and their simpler adaptations, less efficient for all round work but adequate for many uses, and above all, their generally lower price are, if not crowding the American product in this market, at least affecting its more rapid introduction to an extent that American manufacturers that are not directly represented often ignore.

Value of Displays

American machine tools, nevertheless, do find wide distribution throughout the chief industrial centers of France. One Paris dealer has branches and actually carries stock in five different French cities, while others have direct American representatives of the lines they represent attached to their establishments. If American manufacturers knew the importance and the real value of the actual display of their machines in operation and a freer distribution of catalogs (printed in French so far as France is concerned, not in Spanish or English as is too often the case), they would in many instances make pyramid sales through their distributors here. It is by such means that the better adapted, higher production and more efficient (though perhaps a higher priced) tool of American manufacture can be made very often to supplant that offered by British or German competitors or even that of French production in spite of the traditional patriotism of the French towards home products.

France has made notable progress in the machine tool line since the war, although far from attaining the outlook of the American manufacturer, who is nearly always several steps ahead when it comes to time, price and quantity output.

Electrical power units, both stationary and movable, are showing a progressive demand. This branch of the machinery industry is manifestly prosperous under the high tariff protection given it by the government. Actually the demand of the future for such units will be considerably greater than in the past or present, when the vast forests of belts and pulleys which exist are swept out of French manufacturing plants. In the long run this change can only lead to the betterment of manufacturing processes and the greater adoption of high-speed tools.

A significant development of the last month has been the formation of the Compagnie Française pour l'Electricité et l'Industrie, capitalized at 50 million francs, in which the participation of American banking interests and French industrial leaders should ultimately tend to produce a further market for American tool equipment. The French Thom-

son-Houston Co. is moreover on the point of joining up with the important Societe Alsacienne de Construction Mecanique for the production of electro-mechanical elements.

Various big manufacturing units are still protesting that orders are not sufficient to utilize capacity production. This condition is notable with respect to many locomotive and rolling stock plants. The Cail establishment, one of the most important in France, in its annual report, stated that they would be obliged to look for new manufacturing lines in order to utilize their full capacity. This need not be taken as a discouraging statement so far as adding new equipment is concerned, but rather that if space offers and capital is sufficient, they are prepared to add new manufacturing lines as occasion offers in order to reduce overhead. The same observation holds true of many plants scattered all over France. The policy of development by some such plan as this is something that the stabilized franc will do much to encourage. Moreover, by sub-dividing work into smaller product-elements, the plan may also be counted upon to distribute work throughout the year rather than working on the basis of peaks and depressions.

The locomotive and rolling stock manufacturing industry in general gives as an excuse for not equipping with new machinery that the demand of railways in France, comparing the average of the years from 1907 to 1913 to that of 1921 to 1927, has been for but one-third of the locomotives and one-quarter of the rolling stock of the former period. Naturally with the empty space and idle machinery, there is little inducement for them to do anything but make the best use of the facilities they possess. There is little doubt that conditions will some day be improved and a heavy buying era will set in. The recent report of the Locomotive and Rolling Stock Manufacturers' Association deplores present conditions, but states the above as fact.

Motor Drive Urged

The French Committee of Industrial Organization is arguing for the greater adoption of motor drive for machine tools but, as before intimated, suggests that the only way to arrive at this is by the gradual replacement of pulley drive. Mr. Pusard, an engineer of the Arts et Metiers, has just set forth this argument before an assembly of the organization in favor of unit power machines as opposed to even group transmission, and for this reason it would seem that the educative campaign which has actually begun will some day bring forth fruit.

Automobile construction in France in 1928 will exceed, it is believed, 200,000 cars, of which Citroen, Renault and Peugeot stand at the head as to numbers.

Lining up with the satisfactory distribution of American machine tools in France this year, French makers also claim to have had a gratifying volume of business and believe that activity will continue to the end of the year.

Heavy machinery as well as transmission and conveying appliances are making headway in local production, which suggests that the necessity for modern equipment in these lines is considered a phase of progress that should be developed. There is still a long way to go to modernize most French plants in this respect. The small tool industry is considered satisfactory. Shipyards are notably slack in work.

From personal knowledge it is believed that sooner or later a line of trade is possible of development in France for simple but efficient and adequate equipment of what might be called "garage tools," which, in anything but the most rudimentary forms, are notably lacking throughout automotive repair and service shops in France.

Imports from abroad still show a falling off, from those of 1927, of about a billion francs, while exports as well show a dwindling of around two billion francs in value. Imports from the United States fell around 700,000,000 francs; from Germany, 100,000,000 francs and from England 300,000,000 francs in the first five months of the year, the same discrepancies also showing with respect to exports, save to Germany, where there was an increase of 200,000,000 francs.

Manufacturers Assemble to Discuss Industry

The annual meeting of the National Association of Manufacturers will be combined with the semi-annual conference of the National Industrial Council, October 22 to 24, in New York City. This combination of widespread organizations will afford a representative gathering of national industry.

At the first general session on the opening day there will be concise agenda, covering necessary routine, the reports of various committees, and the election of the board of directors for 1928 and 1929. On Monday evening and all of Tuesday and Tuesday evening, there will be numerous group meetings, each arranged with a definite deliberation in view and for the purpose of arriving at a plan of action with respect to each. Tariff, taxation, highways, waterways, railroads, utilities, government in business, business in government, agriculture, platform of industry, industrial relations, the women in industry and the research library in industry, all will come in for more or less detailed handling; also, there will be full opportunity for any or all individual expression desired. These meetings will be conducted in various rooms in the hotel.

Wednesday, the second group meeting, will be devoted to a limited report of the committee to nominate directors-at-large and the election of the directors-at-large.

When that is concluded, James A. Emery, general counsel of the National Association of Manufacturers and the National Industrial Council, will make an address to the joint gathering of the two bodies on the recent and future legislative activities and the trend in our national Congress. Following Mr. Emery's presentation the new board of directors will hold its organization meeting.

In the afternoon there will be deliberations on various topics, discussions from the floor and the report of the resolutions committee.

In the evening will be the annual dinner. This has been planned so that it will afford both its instructive and entertaining features. John E. Edgerton, president of the National Association of Manufacturers and chairman of the National Industrial Council, will make his annual address.

Safety Congress Plans Special Sessions

Arrangements have been completed for the meeting of the seventeenth annual Safety Congress to be held in New York October 1 to 5, the program including a number of important sessions with appropriate discussions. The A.B.C. session features two addresses. The initial address is by David S. Beyer, chief engineer of the Liberty Mutual Insurance Co. of Boston, on "The Part Mechanical Safeguarding Plays," and the second by George F. Prussing, secretary of the safety board of the Union Oil Co. of California, Los Angeles, on "The Other 75 Per Cent."

A newly planned feature is the special session for industrial executives and engineers with the following addresses: "The Origin of Accidents," "Safety and the Individual," and "Safety and Production," the latter by A. W. Berresford, vice-president of the American Engineering Council. A complete program is soon to be issued in booklet form.

Production of Steel Ingots Breaks Record in July

July steel ingot production records were broken by the announcement of tonnages produced by steel plants for the month. According to the American Iron and Steel Institute, 3,811,573 tons were produced as against 3,204,135 in July, 1927. The figure exceeds that of July 1926 by 177,580 gross tons and is 68,608 tons above the June, 1928, output. This high July figure also brought the production figures for the seven months to a record, 28,604,456 tons as against 27,011,522 tons in the same period last year.

The approximate daily production of all companies in July was 152,463 tons against 128,165 in July, 1927, and 143,960 in June. The percentage of operation in July was 80.88 against 69.65 in July, 1927, and 76.37 in June.

Open-hearth production in July was

3,075,247 tons against 2,596,349 tons in July, 1927, and 3,016,487 tons in June. Bessemer production totaled 533,550 tons against 436,883 tons in July, 1927, and 527,351 tons in June.

For 1928 the percentage of operation is based on an annual capacity as of Dec. 31, 1927, of 58,627,910 tons and for 1927 on an annual capacity as of Dec. 31, 1926, of 57,230,350 tons for Bessemer and open-hearth steel ingots.

Company Lunch Rooms Operated at a Loss

Lunch rooms and cafeterias in industrial plants are being maintained in spite of the fact that the majority of them are being operated at a loss, according to an investigation made by the National Industrial Conference Board, of New York. The explanation, according to information gathered and analyzed by the Conference Board, is that the advantages derived from providing such facilities for industrial employees on the whole far outweigh the disadvantages and in the majority of cases observed compensate for whatever loss is incurred.

That reasonable financial loss evidently has not deterred employers from continuing the operation of plant cafeterias and lunch rooms, may be seen from the fact that out of 200 companies which reported annual profits and losses, only 26 showed a profit; 33 covered expenses; 3 made no charge whatever for food or service, and the remaining 134 operated at a loss. Obviously the decision to install a plant cafeteria may carry with it an expenditure running into thousands of dollars, and the operation of a lunch room for employees is in most cases an operation foreign to the industry in which the company is engaged. On the other hand, it may appear a highly desirable policy which will pay dividends in increased working efficiency and general contentment, it is found. The advantages to be gained may outweigh possible disadvantages, or may be offset or be outweighed by them. Careful investigation of all conditions therefore should be undertaken before a decision is made.

Study of the experience of companies operating plant lunch rooms disclosed the following advantages derived from such a policy among 182 companies:

Time saving in case of isolated plants and prevention of tardiness was reported by 61 companies; contented working force, increase in good will and spirit by 12 companies; better health and morale resulted from warm and better food, in case of 51 companies; 4 companies reported reduction of labor turnover; greater convenience resulted in case of plants where there was much extra work, night work, work in shifts or half-hour lunch periods; better sanitary conditions were reported by 6 plants because it eliminated food being taken into the workrooms; 17 companies reported reduction in the cost of living of employees; 8 others noted the furthering of social contacts among employees; greater convenience for the administration, foremen and office staff were experienced by two companies; three others found it facilitated executive and shop committee meetings; the opportunity to close the plant during the lunch hour was cited as a favorable result by three companies; in the case of one company, a percentage of the receipts provides a contribution to the sick benefit fund, and in case of another it gave the employees the evidently desired opportunity to manage their own lunch room; in one case the time saved at noon made possible an earlier closing time.

Only 18 companies reported disadvantages. Three companies complained of the expense; another of the difficulty of serving so many employees at one time; one company declared that it slowed up production; two companies reported tardiness and extra time taken off before the lunch hour, three companies found that many employees did not sufficiently appreciate the service rendered; two companies felt that the space occupied by the plant lunch room might be better used for manufacturing purposes; two others found that operating and purchasing costs are too high for plants with small patronage and for companies serving only one meal a day.

Automotive Production

The Chevrolet Motor Co. produced approximately 120,000 cars and trucks in July, exceeding by a wide margin any previous July in company's history and comparing with 87,134 units produced in July, 1927. Shipments during first seven months this year totaled approximately 871,500 cars and trucks.

The Packard Motor Car Co. shipped 3,805 cars in July, compared with 3,080 in July, 1927. Nearly a week of production was lost during the first part of the month on account of closing for vacations.

The Buick Motor Co. produced 15,000 new Buick cars in July and is currently turning out 900 daily. By first of next week daily production will be stepped up to 1,200 cars. It is planned to ship 32,000 cars in August.

The Chrysler Corporation and Dodge Bros., Inc., together produced approximately 220,000 cars in the first half of the current year, of which Dodge Bros. produced 121,000 units, and Chrysler about 99,000 cars.

The Graham-Paige Motors Corporation, Detroit, shipped 9,010 units in July for the fifth consecutive month, exceeding any previous month in the company's 18 years' history. Total production for first seven months this year was 47,573 units, compared with 12,133 units for corresponding period last year.

Auto plants at Toledo, Ohio, are continuing operations at an active pace, according to the Toledo Edison Co. which reports electrical power output of 36,463,076 kilowatt hours in July. This is a gain of 7,873,111 kilowatt hours against July, 1927, but a slight decline from the 37,681,523 kilowatt hours reported in June, this year.

Latin-American Trade on the Increase

The United States is supplying 39 per cent of the world's exports to Latin America, while its three principal rivals, England, Germany and France, are together supplying but 31 per cent, according to Señor Don Carlos G. Davila, ambassador from Chile to the United States, in a statement issued recently through the National Foreign Trade Council on Latin-American Trade with the United States.

James A. Farrell, chairman of the National Foreign Trade Council, declares in a foreword to the statement, that Ambassador Davila "corrects a long standing error in demonstrating that the remarkable development of our trade with Latin America is due, not to the fortuitous assistance of the war, but to a cycle of growth originating from the powerful expansion of American production and merchandising."

The Ambassador's statement, the result of an inquiry over several years, declares that the outcome of a long course of natural and friendly enterprise extending over the past 30 years has brought about the leadership of the United States in exports to every single Latin-American country. It is now evident in Latin America, he points out, that the war period by its artificial and transitory inflation rather interrupted the logical growth of inter-American trade than aided it.

With the sole exception of the year 1921, the United States has always bought more from Latin America than it has sold to it. In 1927 the imports from the southern republics reached $1,019,000,000 against $845,000,000 of exports. During the sixteen-year-period between 1912 and 1927, American exports to the Latin-American republics amounted to $11,000,000,000, while the imports from those countries to the United States were $15,000,000,000. It should be understood, however, that many exports to the United States are the product of industries operated by American capital.

In 1912, Latin America bought from Great Britain 25 per cent, more or less, of its total imports, from the United States, 24 per cent, from Germany, 16 per cent, and from France, 8 per cent. Today the situation has been inverted: the United States ranks first in supplying Latin America, with 39 per cent of its imports, while Great Britain has taken second place with 15 per cent, followed by Germany with 10 and France with 6 per cent.

The Business Barometer

The outlook in Commerce, Finance, Agriculture and Industry

By THEODORE H. PRICE

Editor, Commerce and Finance, New York

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THE ship of business is making good speed over a calm sea, and along the course ahead are only three hazards that compel watchfulness. One is the possible reappearance of the ghost of the presidential year in business, which had seemed so thoroughly laid. The second is the increasing evidence that money is more likely to be dearer than cheaper in the fall. And the third is the decline in the country's two greatest cash crops, wheat and cotton, both of which dropped last week to the lowest prices of this season.

Of these the first is the least important, but in a dull midsummer week it has been much discussed. It was raised by reports that P. S. duPont would resign the chairmanship of the General Motors Corporation in order that he might be free to work for the candidacy of Governor Smith. Concurrently a rumor was circulated that John J. Raskob would not rejoin General Motors after the campaign, and that he was selling out his personal holdings of the corporation's stock. Mr. duPont's resignation was forefended by giving him leave of absence, and Mr. Raskob has denied an assertion that he will become an official of the Radio Corporation, but the stock market was unsettled by the stories for a time.

But if politics may bring about changes in business the reverse is still more true, and it is becoming apparent that the farm problem in the fall may present itself even more insistently than it did to the party conventions. This statement is occasioned by the continuing decline in cotton and wheat, which, while they rank below corn in the value of their product, nevertheless are the most important sources of ready cash on the farms in the autumn. The declines in wheat and cotton, the prospective drop in corn that is indicated by the discounts on futures, the disastrously low price of potatoes, and the poor returns that many producers of fruits and vegetables will be compelled to accept because their farms and orchards have produced bountifully, indicate that the crops will return no more to the farmer than they did last year.

While the two great crops made new lows, cattle and hogs concurrently made new highs for the year and the buying power of the livestock regions should be the highest in many years. The government last week issued a cotton crop estimate of 14,291,000 bales which was half a million below the average expectation, but after the first advance the market dropped so violently that it is evident the figure fails to find general acceptance as a measure of the present prospect. The textile industry is so blue that spinners offer little support for cotton, but the threat of a crop scare is constantly present.

The third of the hazards mentioned is the probability of continued firm money rates, which has not been diminished by the events of the week. Efforts to reduce the total of brokers' loans in New York have again been unavailing, and they showed another increase of $14,500,000 last week. In light of the discussion of "bootleg money" that has been going on, the distribution of these loans is particularly interesting. Those placed by the New York banks for their own account declined $68,000,000, while those for out-of-town banks gained $51,000,000 and those "for others" increased $31,000,000. The obvious conclusion is that the high rates maintained here are defeating their own object by attracting all the excess money of the country to the stock market, neutralizing the efforts of the New York Reserve and member banks to curtail security loans. When business demand for funds increases in the autumn the result will doubtless be firmer money unless the Reserve Banks come to the rescue and supply sufficient credit, by purchasing government securities, to avert a further advance.

But dearer money thus far has had little measurable effect on business. New bond issues during July were the smallest in many years, which may portend a decline in expenditures on construction and equipment. But it is not yet evident. Construction contracts awarded east of the Rockies during July, according to the F. W. Dodge Corporation, were the highest on record and 9 per cent above that of a year ago. Industrial reports as a whole convey a picture of unusual activity for midsummer, with the important exception of cotton textiles, which have again been unsettled by price declines. The steel industry is extremely cheerful, reporting a gain in ingot production during July and but slight curtailment since, while the better price is evidence of continuous buying. The automobile manufacturers also report high summer production rates, and satisfactory sales and stocks.

Abroad there is much that fills the headlines, but little that concerns American business directly. The most important fact in international business is the cessation of our gold shipments abroad; in fact, some of those countries which have recently acquired the gold are hard put to hold it and may have to resort to support of their currency in the exchanges. Thus no further narrowing of our credit base presently is to be feared. If expansion of the structure erected on that base were not to be expected the future could probably be viewed with great assurance, for the record that industry is making this summer is undeniably impressive.

WHAT'S DOING IN INDUSTRY

WITH but few exceptions, activity in machine tool sales is holding up remarkably well throughout the country this summer. In New York, after some spectacular buying on the part of two companies which made July a record month, scattered business continues in high volume for the season and enough business is pending to justify the prediction that August will be equally as good as the previous month.

IN CINCINNATI, reports are also cheerful, and with sales on the increase and inquiries coming in freely, the prospects are bright. A favorable demand is found in Milwaukee, where confidence is expressed as to an active fall and winter. Machine tool business in New England has also been holding up remarkably well, particularly in small tools, and August sales are expected to equal those of July—a good month. Most builders of such equipment are working at full production.

ONLY a slight recession has been noted in Chicago in the past few weeks. August buying is expected to be well above the volume a year ago. In Indianapolis, on the other hand, business has slowed down. The demand from automotive shops is not up to expectations, nor is school buying—an active source for orders in New England at present. Detroit also reports a pronounced summer slump, although general business is active and employment figures are the highest in some time. An early pickup is anticipated, however. indications of early fall activity are also seen in the Philadelphia market, which has been dull for some weeks.

The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

NEW YORK

Little change is expected to take place in the high activity of the New York machine tool market over what was experienced in July—a banner month for this season, in fact, one of the best this year. This prediction is made despite the fact that the sensational buying of the Wright Aeronautical Corporation and the General Electric Co. is over for the present at least. Two dealers report a scarcity of orders in the past week, but state that there is every indication from the character of business pending of a good volume of well-scattered orders being placed later in the month. Inquiries are holding up well and are coming from sources little heard of in the past half year. The only indication of a possible letup in industrial activity is the fact that some of the small shops are finding very few jobs to keep them active.

Several big deals are said to be pending. One company reports an inquiry involving about fifteen machines from a public utility company in New York State. Railroad tool buying as for some time has been slow, although large orders are reported for cars and engines. The New York Central bought two Monarch lathes, and a Niles car-wheel lathe was sold to a company in Pennsylvania. Sales of a miscellaneous lot of standard machine tools were made to railroads in Chicago, but few so-called railroad tools have been sold in the past week. Some orders are expected to develop soon, however, in the South and in New England.

Sales reported by the Triplex Machine Tool Co. included: three Edlund high-speed drill presses, a 13-in. lathe, two 20-in. Springfield lathes, a Swiss jig borer to a firm in New York City, four Ohio tool and cutter grinders, one Niagara punch press, one Campbell nibbler, two high-speed riveting machines, and a large Ohio miller to a firm in Connecticut.

CINCINNATI

Reports made by machine tool manufacturers of the Cincinnati district in regard to the past week's business were unusually cheerful for this season of the year. Taking the trade as a whole there was a gain in sales, the majority reporting an increased volume of orders and none reporting a decrease. "There was a good volume of general buying in the past week," stated one manufacturer. "Business held up very well in the period and in my opinion prospects are encouraging," said a second. "We received a good volume of single orders in the week, and an increased percentage of our inquiries developed into sales," explained a third. "The week's business was very good, considering the season, and the inquiries received were satisfactory as to nature as well as to volume," commented a fourth.

Selling agents stated that making allowance for the vacation season, the week's business was better than fair, showing a gain over the same period of the previous year.

The week's sales volume was mainly sustained by the purchase of a well-diversified line of single tools by general machinists and miscellaneous users, well scattered geographically. One concern reports the sale of five lathes to the same number of users, each in a different line. Scattering buying of single tools was done by railroads and by automobile and accessory manufacturers.

The great majority of the manufacturers report that inquiries came in quite freely during the week, from all sections of the country and for all varieties of tools. It is stated that the number and the nature of these inquiries give much encouragement and indicate that there is about to arise an increased demand. Several manufacturers predict that soon there will be a better demand from automotive centers and from railroads.

PHILADELPHIA

Machinery and machine tool sales in the Philadelphia area were light in July and have been so thus far in August, heads of various firms reported during the week.

Manufacturers of equipment used in industrial plants, such as leather belting, reported a rather brisk business, indicating to many that preparations are under way for an active fall. This is particularly true of the steel and oil refining industries. Purchases from the textile mills have not advanced as rapidly as many manufacturers had hoped.

There were some sales to Southern producers of cotton seed oil, and the automotive industry has made some response to the Philadelphia market although the purchases were not large. Some Eastern railroads have made inquires, and the inquiries from general industrial lines have been somewhat spasmodic. Manufacturers of metals reported a lull in the first few days of August, and producers of gears said their business had been keeping up fairly well, with few new customers in the market.

INDIANAPOLIS

Vacations and hot weather have combined to slow down the machine tool and machinery business here. No large orders have been placed during the last two weeks, though some small sales are being made. The prospective buying of lathes and other similar tools by various boards of school commissioners for manual training in the different schools is smaller than it was at this time last year. Some of this machinery is rather badly needed both for replacements and also for increasing school facilities, but the tendency is to delay buying just as long as possible. Under the state law this equipment must be advertised for and sold to the lowest bidder.

There is some special equipment being sold to electric companies, who among the utilities, have been the most consistent buyers this year. The railroads are not buying heavily, but are buying their actual requirements. Reports from some sections of the state show more men being put to work in the shops following an early summer curtailment in many of them.

The automobile demand is not so good. Spring business started out in good shape, but the factories, at least as far as Indianapolis is concerned, did not operate at capacity long and business during the summer has been light. At Newcastle and South Bend, however, the situation is a little better.

Some sales are being made to small machine shops, most of which are operating rather steadily for this time of the year. Judging from reports of fall prospects in the furniture industry, this line will be an exceptional prospect for special woodworking machinery. The summer shows were successful for most of the Indiana factories and they are being put under more pressure for fall delivery.

DETROIT

The periodical summer slump is still very pronounced here and thus far there seems little indication of improvement. The automobile business in general is slow but business as whole seems to be increasingly good. Employment is still mounting and is now very much higher than it was at this time last year. There is a definite feeling of prosperity which is well substantiated by general activity in almost all lines.

Vacation time has cut deeply into the market for machinery and machine tools and business in the trade is very spotty and uncertain. Now and again a few good sized orders or inquiries come in but they are few and far between. The showing of new models by Buick, Chrysler, Hupmobile and other manufacturers has not yet influenced the machinery market in any way and may not do so for a long time.

Graham-Paige is spending $1,500,000 on plant and equipment in an effort to bring production up to 600 cars a day. Approximately 400 cars a day are now being turned out. In addition to new plant construction at the main plant in Detroit, at the body plants in Wayne, Mich., and Evansville, Ind., the company is buying a group of buildings in Detroit for added floor space. More than $300,000 is being spent for equipment.

The Oakland and Pontiac plants are making some expansions to take care of increased demand. The Chrysler-Dodge merger has had no apparent effect on the trade and probably will not have for a long time. Chrysler is doing a little buying, but not of a great deal of importance. Ford is still building up production slowly and is now said to be turning out 3,000 cars a day.

The indications are now that things will pick up somewhat in September. If the last six months are as good as the first, 1928 will be a record year for the trade. Even if the last six months is much below, the average will still be very high.

NEW ENGLAND

The month of August to date has been a repetition of July, with business in the machinery and machine tool field holding up remarkably well. The sale of small tools continues to be a strong factor in the New England market and larger units are not far behind. The week was the most active of the present month, representative tool manufacturers booking orders for jig boring, die sinking, milling, vertical drilling and general production machinery units.

A central Connecticut company, among the largest tool builders in the country, reports business for the first six months of the year as decidedly good with production running to capacity, necessitating night work in many departments. An official of this concern states: "Present production is holding up exceptionally well and orders are being booked in favorable fashion. We are adding constantly to our working force and production is running at capacity for a full working schedule."

With few exceptions this is the view of representative manufacturers in the New England section. Orders for the several

machine tool lists issued by the City of Boston and for which bids were received some time ago, are being placed from time to time. Boston companies, a Western Connecticut concern and a Providence builder have orders from this source. The Holmes Products, Inc., Bridgeport, is proceeding with plans to establish a plant. About 125,000 sq.ft. of floor space in the Remington Arms plant will eventually be utilized for the manufacture of electric refrigerators. Equipment will be bought to include welding machinery, small automatics and other tools.

CHICAGO

Business in machine tools for the first ten days of August shows but a slight recession from the last half of July. In some lines of production there is an increase, and from present indications this month will go beyond August of last year in the volume of trade by a considerable percentage. Buying on the part of agricultural implement and tractor manufacturers continues to be the principal factor in the market, the International Harvester Co. leading in the number of tools purchased.

Railroads are reported to be preparing new lists, one road in particular being expected to enter the market shortly with a list of large proportions. The Chicago Board of Education is asking bids on equipment for some of the Junior High Schools, for which lathes, grinders and woodworking machinery are needed. Industrialists are buying freely, their requirements covering a wide range of tools. Manufacturers of grinding machines and abrasives report business as on a higher lever than for the last several years.

Demand for used tools, while not active, is fairly satisfactory, the season considered.

MILWAUKEE

Nothing has occurred during the past fortnight to make the machine tool trade less confident of active fall and winter business than it has been for a month or longer as the result of the favorable state of demand all summer long. Although not all shops are as well situated as some, bookings average well and represent a better state of affairs than existed last year at this time. Such is the pressure upon some shops by buyers desiring early delivery that all available skilled machine shop labor is employed, and in some cases complaint is heard of inability to man shops as thoroughly as conditions warrant.

Local metalworking shops are furnishing a relatively good volume of business to tool manufacturers here and elsewhere. Shop extensions now under way or in prospect are the most important in more than a year's time and reflect an improving situation. The conservatism with regard to shop enlargement has not vanished, but the fact that some of the largest industries in this territory are engaged in extensive additions is accepted as evidence that not only has there been a material improvement in demand, but there is well grounded confidence that it will continue to grow better and keep the expanded facilities busy.

Automobile factories are doing more buying, and much more is looked for, with the retail situation concerning passenger cars more favorable than had been expected, and vastly better than a year ago. The tractor industry, which has loomed as one of the really importance sources of tool business for many months, is good for considerable more volume, with two major producers in Milwaukee again making extensions. While occasional orders are being received from railroads, improvement in this direction is looked for.

BUFFALO

While machine tool dealers are well aware that this is the vacation season, this is by no means the worst summer for business which has been known in this territory. In fact, considering the season, business is fairly good. With the books closed for July, several offices report business for that month somewhat in excess of that for July, a year ago.

Conditions are quiet in the electrical equipment field, orders being almost exclusively for single pieces of equipment or small orders. There is considerable construction in this section and the demand for equipment in this field is good. Competition continues keen.

Aluminum Plating Accomplished

Electro-deposition of aluminum on metal, successfully accomplished by Prof. D. B. Keyes of the University of Illinois, was explained in an address recently before the American Chemical Institute.

Pure aluminum will withstand the corrosive action of most concentrated acids and all common sulphur compounds, but has little tensile strength or elasticity. The new process, which makes use of organic metallic complexes that are liquid at ordinary temperatures, allows the electro-deposition of a continuous coat of aluminum on steel and other materials.

By cutting the price of replacement of equipment in the cracking process of fuel manufacture through the new plating, gasoline prices may be lowered. The process also may prolong the life of locomotive parts as well. Automobile lacquer finishes may be entirely replaced by a new finish having the same quick drying qualities and increased durability and luster.

A.S.S.T. Meeting Papers Cover Wide Field

Papers by leading men in the metal industry will be presented at the technical sessions of the American Society for Steel Treating, to be held during the National Metal Exposition in Philadelphia, Oct. 8-12. Coincident with the metal exposition will be held National Metal Week, at which the American Welding Society and the Institute of Metals will also hold technical sessions.

Among the papers to be presented at the A.S.S.T. sessions are: The Cutting Qualities of an Alloy Steel as Influenced by Its Heat-Treatment, by Prof. O. W. Boston, University of Michigan, and M. N. Landis, Landis & Landis, Chicago; Metallurgical Problems of Transmission Gearing, by E. F. Davis, Chief Metallurgist, Warner Gear Co.; Surface Cooling of Steel in Quenching, by H. J. French, G. S. Cook, and T. E. Hamill, Bureau of Standards; High-Carbon, High-Chromium Steels, by J. P. Gill, Vanadium Alloys Steel Co.; Cloudburst Process for Hardness Testing and Hardening, by Edward G. Herbert, Manchester, England.

The Surface Hardening of Special Steels With Ammonia Gas Under Pressure, by Raymond H. Hobrock, Engineering Experiment Station, Purdue University; A New Tool Material, by Dr. S. L. Hoyt, Research Laboratory, General Electric Co.; A New Method for Heat-Treating High-Speed Steel, by H. C. Knerr, Consulting Metallurgist, Philadelphia; Depth and Character of Case Induced by Mixtures of Ferro Alloys With Carburizing Compounds, by E. G. Mahin, Notre Dame University, and R. C. Spencer, Caterpillar Tractor Co.; Service Annealing of Sling and Crane Chains, by W. J. Merten, Westinghouse Electric & Manufacturing Co.; Progress Made in the Use of Electric Furnaces for Heat-Treating, by A. N. Otis, General Electric Co.; Chromium Copper Steels as Possible Non-Corrosive Ferrous Alloys, by B. D. Saklatwalla, vice-president and A. W. Demler, metallurgist, Vanadium Corporation of America; Heat-Treatment of High Speed Steel to 2,400 deg. F., in Molten Lead, by W. C. Searle, Leland-Gifford Co.; Decarburization of High-Carbon Steel in "Reducing" Atmospheres, by J. J. Curran, and J. H. G. Williams, Henry Souther Engineering Co.; Application of Normalized Steels to Crankshafts and Other Automotive Parts, by H. T. Chandler; Chromium in Silicon Manganese Steels for Engineering and Structural Application, by A. B. Kinzel, Union Carbide & Carbon Research Laboratory.

High-Speed Diesel Motor Perfected in Germany

A new high-speed Diesel motor designed specially for use in buses, trucks and railway motor cars is reported to have been perfected by a Breslau machinery manufacturer, Trade Commissioner James E. Wallis, Jr., Berlin, informs the Department of Commerce. The new motor, using heavy fuel oil for combustion, is expected to prove successful. Its low weight combined with a high speed of rotation is declared to enable it to compete with other types of internal combustion engines of equal power. Depreciation in the motor is reported very low, and danger due to the high speed is said to be obviated by a specially designed lubricating system. Its makers expect the new motor to be used extensively for stationary installations, especially for the generation of electric current and for operating pumps and compressors.

Financial Notes

The Curtiss Aeroplane and Motor Co. reported its second quarter net profit of $401,722, against $233,193 in the 1927 period. Profit for the first six months was $591,844 after interest, federal taxes and other charges, against $332,251 in the first half of last year.

The income account of the Timken Roller Bearing Co. for the first half of 1928 revealed a gain in net earnings of almost $1,000,000 over the corresponding six months of 1927. Net income for the period amounted to $6,395,573 after all charges and Federal taxes, equivalent to $5.32 a share on 1,200,882 shares of no par stock. In the same 1927 interval the company reported earnings of $5,406,834, or $4.50 a share.

Earnings of $2,084,383 at the rate of $2.83 a share were reported by Mack

Trucks, Inc., for the second 1928 quarter. This was greater than those announced in both the previous and the corresponding periods of last year.

Net income of $2,978,601 for the June quarter for the International Nickel Co. was more than double that of the corresponding quarter in 1927.

Marion Steam Shovel Co. reports for six months ended June 30, 1928, net profit of $379,016 after interest, federal taxes, etc., equivalent after dividends on 7 per cent preferred stock to $5.41 a share earned on 50,000 shares of common outstanding at end of the period.

Business Items

After September 1, the address of the Ex-Cell-O Tool & Manufacturing Co. will be 1200 Oakman Blvd., Detroit, Michigan.

The Square D Co., a Michigan corporation, has filed an affidavit with the secretary of state in Indianapolis designating George G. Kent, Peru, Ind., as their Indiana agent.

The Superior Machine Tool Co., Kokomo, Ind., has filed papers with the secretary of state in Indianapolis, changing its capital stock from $500,000 to 50,000 shares of no par value.

The McLoughlin Screw Products Co., 111 W. Washington St., Chicago, has been incorporated. The company will manufacture and deal in and with bolts, nuts, and hardware specialties. Capitalization $50,000.

The Billings & Spencer Co., of Hartford, Conn., has opened a sales office at Room 1205, 71 Murray St., New York, N. Y., to serve the metropolitan and Philadelphia districts. W. Roy Moore is sales manager in charge, and Robert C. Smith is in charge of export sales.

The Lufkin Foundry & Machine Co., Lufkin, Tex., announced recently that the company had obtained an amendment to its charter increasing the capital stock from $400,000 to $600,000, and that an improvement and enlargement program was contemplated. This company manufactures machinery and machine parts.

The Follen-Strom Manufacturing Co. has purchased a new plant in Kenosha, Wis., where it will continue to make a line of check and bond perforating machines. The company is also building a new Diesel engine from 100 to 400 hp. The new plant has 45,000 sq.ft. of floor space and is on the main line of the Chicago & North Western R.R. James H. Follen is president and Carl A. Strom, vice-president and general superintendent.

The Fairchild Manufacturing Co., Lafayette, Ind., maker of differentials, bevel and spiral bevel gears, has completed an addition, 80x100 ft. to the main factory. A new heat-treating building, 30x110 ft. has also been built, and equipment is being installed in both additions. Business for the first six months of this year was greatly in excess of any previous six month period, and has necessitated an expenditure of approximately $150,000 for various machine tools.

Organization of the Verville Aircraft Co., Detroit, to manufacture small low-priced planes and flying boats was announced by B. F. Everitt, former automobile manufacturer who is president and general manager of the new concern. Alfred V. Verville, an airplane designer, is in charge of engineering. The Rickenbacker Motor Co. property, having 300,000 sq.ft. of space, was purchased recently for the Verville company. It will be the largest airplane manufacturing plant in Detroit and one of the largest in the country.

A block of land adjoining the International Harvester Co. Farmall tractor plant in Rock Island, Ill., has been acquired by the company and negotiations opened with the city for vacation of the street separating the present plant and the newly acquired area. A. E. H. Sohner, superintendent, said that future plans of the company have not been decided upon, but acquisition of the block with title to the street opens way to great expansion of manufacturing facilities. The plant is at 43rd St. and Fifth Ave. and the new land extends to 44th St., immediately east of the factory.

Williams, White & Co., Moline, Ill., will have its new foundry, being built on site of the present plant without interruption of the summer's production schedule, in operation about November 1, it was announced last week. The building will be 86 x 240 ft. with two bays, one 50 ft. wide with two traveling cranes and the other 30 ft. with two 3-ton tramrail cranes. An outside stock yard, 40x240 ft. with a 5-ton traveling crane; a new 66-in. cupola, making three cupolas in operation; a 13x18- and a 7½x18-ft. car type core ovens, oil-heated, are other improvements included in the program.

Personals

ALBERT E. GROVER has been appointed cost consultant on the staff of General Manager E. F. DuBrul of the National Machine Tool Builders' Association.

PRESLEY HAMILTON has been appointed New York district sales representative for Gears and Forgings, Inc., of Cleveland, and his office is at 149 Broadway.

WILLIAM M. HENRY has been elected president of the Oswego Tool Co., Oswego, N. Y., to succeed his father, the late William J. Henry. Paul A. Henry has been made vice-president, and C. N. Winfield, secretary.

J. H. WELLER, general manager of the Acme Motor Truck Co., Cadillac, Mich., for the past two years, has become works manager of Sargeant Lock Co., New Haven, Conn. L. C. Klesner, assistant manager and sales director of the Acme company, succeeds Mr. Weller as general manager.

B. M. GRAVES, Greenville, S. C., who for some years was president of the Southern Textile Machinery Co., of that city, distributors of textile equipment in the Southeast, is now associated with the sales department of the Greensboro Supply Co., Greensboro, N. C., distributors of machine tools, power and lighting equipment, etc., being identified with the textile department of this company.

Obituaries

GEORGE ROWE, 84 years of age, Civil War veteran and tool manufacturer of Cincinnati, died recently at his home. Mr. Rowe founded the saw manufacturing plant which he and his sons operated.

WILLIAM A. PARKER, 65, who for 23 years was purchasing agent for the Bessemer & Lake Erie R.R. and the Union R.R. of the United States Steel Corporation, died on August 6 at his farm in Hesston, Pa.

WILLIAM B. YOUNG, president of the Crescent Firearms Co., Norwich, Conn., died August 5 at the age of 81 at his home in that city. Mr. Young was also president of the Lee & Osgood Co., and vice-president of the Thames National Bank of Norwich.

FRANK W. GOODRICH, for forty years connected with the Graton & Knight Co., of Worcester, Mass., died on August 12 at the age of 56. For the past 20 years he had been superintendent of the firm's factory.

FRANK M. LEAVITT, engineer and inventor, and chief engineer of the E. W. Bliss Co., Brooklyn, N. Y., died recently at his home after several years of ill health. His inventions were of far-reaching importance to the industrial world. His automatic can-making machine greatly benefited the canning industry, while his toggle draw press was the first to be brought out. Mr. Leavitt perfected the Bliss-Leavitt torpedo, now used by the United States Navy, said to be one of the most ingenius and sensitive mechanisms ever devised. He had been with the Bliss company for more than 50 years. He was a member of the American Society of Mechanical Engineers, the American Society of Civil Engineers, Society of Naval Architects and Marine Engineers, the American Association for the Advancement of Science, and the Engineers' Club.

BENJAMIN THURSTON, a director and general superintendent of the American Screw Co., Providence, R. I., died August 3 at the Massachusetts General Hospital, Boston. Mr. Thurston was in his 81st year and had been attentive to business up until the last of June. He had been associated with the screw company for 50 years, and previously was a machinist with the Brown & Sharpe Manufacturing Company.

Forthcoming Meetings

Canada's Steel and Power Show. Second annual show to be held at the University of Toronto Arena, Sept. 4-7. Secretary, Campbell Bradshaw, 24 Front St., Toronto, Ontario.

American Railway Tool Foremen's Association. Annual meeting, Hotel Sherman, Chicago, Sept. 12, 13 and 14. G. G. Macina, secretary, 11402 Calumet Ave., Chicago.

American Railway Tool Foreman's Association. Sixteenth annual convention of the Supply Association, Hotel Sherman, Chicago, Sept. 12, 13 and 14. F. A. Armstrong, secretary, the Pratt & Whitney Co., 564 W. Monroe St., Chicago.

Machine Shop Practice Division, American Society of Mechanical Engineers. National meeting, Cincinnati, Sept. 24-26. Part of sessions to be on steamer "Cincinnati." Secretary, Carlos de Zafra, 29 W. 39th St., New York City.

National Safety Council. Seventeenth annual safety congress to be held in New York, October 1-5. W. H. Cameron, managing director, 108 E. Ohio St., Chicago.

American Society for Steel Treating. "National Metals Exposition," Commercial Museum, Philadelphia, Pa., week of Oct. 8. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

American Welding Society. Fall meeting and exposition, Exhibition Hall of Commercial Museum, Philadelphia, Pa., Oct. 8-12, in conjunction with "National Metals Exposition" of the American Society for Steel Treating. Miss M. M. Kelly, secretary, 29 West 39th St., New York City.

Institute of Metals, Division of American Institute of Mining and Metallurgical Engineers. Annual fall meeting during National Metal Week, Oct. 8-12, Benjamin Franklin Hotel, Philadelphia. W. M. Corse, secretary, 810 18th St., N. W., Washington, D. C.

American Gear Manufacturers Association. Semi-annual meeting, Statler Hotel, Buffalo, N. Y., Oct. 11-13. T. W. Owen, secretary, 3608 Euclid Ave., Cleveland, Ohio.

Society of Industrial Engineers. Fifteenth annual convention, Rochester, N. Y., October 17-19, in conjunction with the Industrial Management Council of the Rochester Chamber of Commerce. George C. Dent, executive secretary, 205 Wacker Drive, Chicago.

National Manufacturers' Association. Combined assembly with the National Industrial Council in New York City, October 22-24. George S. Doudinot, secretary, 11 W. 42nd St., New York City.

American Management Association. Autumn convention, Palmer House, Chicago, Nov. 13-15. W. J. Donald, managing director, 20 Vesey St., New York City.

Iron and Steel Division, American Society of Mechanical Engineers. Second national meeting, Chicago, November 14-15. Thomas Wilson, chairman of Chicago local section host, 7 S. Dearborn St., Chicago.

The Weekly Price Guide

Rise and Fall of the Market

THE U. S. Steel Corporation's report issued Aug. 10, on unfilled orders at hand July 31, 1928, of 3,570,927 tons, represents a drop of 66,082 tons from the June bookings. At the same time, these orders show heavier demand than on July 31, 1927, at which time there were 3,142,014 tons in unfilled orders, a gain of 88,768 tons, compared with the June 30, 1927, bookings. Finished steel prices are firm at $1.85 per 100 lb., Pittsburgh, for bars, shapes and plates in large mill lots. Heavy melting scrap is up 75c. per ton at Pittsburgh. Pig iron is steady. In non-ferrous metals, demand for copper and zinc is light, with that of tin, stronger and lead, fair.

(All prices as of Aug. 10, 1928)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$19.69
Northern Basic	20.89
Southern Ohio No. 2	21.19
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	25.62
BIRMINGHAM	
No. 2 Foundry	16.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	20.76
Virginia No. 2	27.17
Basic	19.76
CHICAGO	
No. 2 Foundry local (silicon 1.75@2.25)	20.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	22.01
PITTSBURGH, including freight charge ($1.76) from Valley:	
No. 2 Foundry	19.26
Basic	19.26
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4 50
Cleveland	5.00
Cincinnati	4.30
New York	5.25
Chicago	4.50@4.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.00@2.10	3.35	3.25	3.90*
No. 12	2.05@2.15	3.40	3.30	3.95*
No. 14	2.15@2.25	3.45	3.35	4.00*
No. 16	2.25@2.35	3.55	3.45	4.10*
Black				
Nos. 18 to 20	2.65@2.70	3.60	3.20	4.00
No. 22	2.80@2.85	3.75	3.35	4.15
No. 24	2.85@2.90	3.80	3.40	4.20
No. 26	2.95@3.00	3.90	3.50	4.30
No. 28	3.10@3.15	4.05	3.65	4.45
Galvanized				
No. 10	2.70@2.85	3.95	3.55	4.25
Nos. 12 to 14	2.80@2.95	4.05	3.65	4.35
No. 16	2.90@3.05	4.15	3.75	4.45
No. 18	3.05@3.20	4.30	3.90	4.60
No. 20	3.20@3.35	4.45	4.10	4.75
No. 22	3.25@3.40	4.50	4.15	4.80
No. 24	3.40@3.55	4.65	4.25	4.95
No. 26	3.65@3.80	4.90	4.50	5.20
No. 28	3.90@4.05	5.15	4.75	5.45

*250 to 3,999 lb.

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in., butt welded	50%	36%	55½%	43½%	54%	41%
2½ to 6 in., lap welded	45%	32%	53½%	40½%	51%	38%

WROUGHT-STEEL PIPE LIST

Size, Inches	List Price per Foot	Diameter in Inches—External	Diameter in Inches—Internal	Thickness Inches
⅛	$0.17	1.315	1.049	.133
¼	.23	1.66	1.38	.14
⅜	.27½	1.9	1.61	.145
½	.37	2.375	2.067	.154
⅝	.58½	2.875	2.469	.203
¾	.76½	3.5	3.068	.216
⅞	.92	4.0	3.548	.226
1	1.09	4.5	4.026	.237
1⅛	1.27	5.0	4.506	.247
1¼	1.48	5.563	5.047	.258
1½	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb.:

Thickness—Decimal	B.w.g. and Fractions	Outside Diameter in Inches—½	⅝	¾	⅞	1	1⅛	1¼
		Price per Foot						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
.065"	16	.19	.20	.21	.22	.23	.25	.27
.083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse base prices in cents per lb.:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered Bessemer rods	6.05	6.00	6.20
Hoop steel	4.50‡	4.00	4.15
Cold rolled strip steel	6.25	6.00	6.10
Floor plates	5.10‡	5.30	5.00
Cold drawn, round or hexagon†	3.40	3.65	3.60
Cold drawn, flat or square†	3.90	4.15	4.10
Structural shapes	3.30‡	3.00	3.10
Soft steel bars	3.25‡	3.00	3.00
Soft steel bar shapes	3.25‡	3.00	3.00
Soft steel bands	4.00‡	3.65	3.65
Tank plates	3.30‡	3.00	3.10
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	60%	55%	50%

*Flat, 3/16@½-in. thick. †Cold finished steel, shafting and screw stock. ‡250 to 3,999 lb., ordered and released for shipment at one time.

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to ½ 7.35c. per lb.

METALS

Warehouse Prices in Cents Per Pound for Small Lots:

Copper, electrolytic, New York			15.50
Tin, straits, pigs, New York			51.00
Lead, pigs, E. St. Louis	6.00	New York	7.75
Zinc, slabs, E. St. Louis	6.25	New York	7.75

	New York	Cleveland	Chicago
Antimony, slabs	12.50	13.00	14.25
Copper sheets, base	23.50	23.50	23.50
Copper wire, base	20.12½	19.62½	16.75*
Copper bars, base	22.00	22.00	22.50
Copper tubing, base	25.00	25.00	25.00
Brass sheets, high, base	19.25	19.25	19.25
Brass tubing, high, base	24.12½	24.12½	24.12½
Brass rods, high, base	17.00	17.00	17.00
Brass wire, high, base	19.75	19.75	19.75

*At mill

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%.....	25.00*	24.30	24.30
Zinc sheets (casks).....	10.00@10.50	11.00	9.61
Solder (strictly).....	32.25	30.75	31@34
Babbitt metal, delivered in case lots, New York, cents per lb.:			
Genuine, highest grade.....			67.75
Commercial genuine, intermediate grade.....			53.00
Anti-friction metal, general service.....			31.50
No. 4 babbitt (f.o.b.).....			12.25
Nickel, f.o.b. refinery, Bayonne, N. J., cents per lb.:			
Ingots..... 35.00	Electrolytic.. 37.00	Shot.....	36.00

*Delivered.

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Full finished nickel sheet (base).....	52.00
Cold rolled nickel sheet (base).....	60.00
Hot rolled rods, Grade "A" (base).....	45.00
Cold drawn rods, Grade "A" (base).....	53.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot.....	28.00	Hot rolled rods (base)...	35.00
Blocks.....	28.00	Cold drawn rods (base)..	43.00
Cold rolled sheets (base)	50.00	Full finished sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound, f. o. b. cars, depending on quantity:

	New York	Cleveland	Chicago
Crucible copper.....	12.75 @13.00	12.00	11.75@12.25
Copper, heavy, and wire..	12.00 @12.75	11.25	11.25@11.75
Copper, light, and bottoms	10.62½@11.12½	9.75	10.00@10.50
Heavy lead.....	5.00 @ 5.12½	5.25	4.50@ 5.00
Tea lead.....	3.50 @ 3.75	3.75	3.50@ 4.00
Brass, heavy, yellow.....	7.25 @ 7.50	7.75	7.25@ 7.75
Brass, heavy, red.....	10.00 @10.25	10.00	9.50@ 9.75
Brass, light.....	5.50 @ 6.00	6.25	6.25@ 6.75
No. 1 yellow rod turnings.	8.00 @ 8.25	7.75	7.50@ 8.00
Zinc.....	3.25 @ 3.50	3.25	2.87½@3.37½

TIN PLATES—Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20.....	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20.....	9.70	9.90	9.50
	Coke Plates—Primes—Per box			
100-lb.,	14x20.....	6.45	6.10	7.00
	Terne Plates—8-lb. Coating—Small lots—Per box			
IC,	14x20.....	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.*	$0.10@0.13½	$0.16	$0.15
Cotton waste, colored, per lb.*	.09@ .13	.12	.12
Wiping cloths, washed white, per lb.....	.15½	38.00 per M	.17
Sal soda, per lb.....	.02	.02	.02
Roll sulphur, per lb.....	.027	.03½	.04
Linseed oil, raw, in 1 to 4 bbl. lots, per lb.....	.105	.105	.107
Cutting oil, about 25% lard, in 5 gal. cans, per gal....	.65	.60	.60
Machine oil, medium-bodied (55 gal. steel bbl.) per gal.....	.30	.36	.36
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin.ft. per inch of width for single ply.:			
Medium grade.....	30–10%	30–10%	35%
Heavy grade.....	25–5%	30–5%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft.:			
First grade.....	50%	50–10%	50%
Second grade.....	60%	60–5%	50–10%

*All waste in bale lots.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars.....	per lb.....	$0.0325	$0.0325	$0.0324
Cold drawn shafting....	per lb.....	.034	.034	.04
Brass rods.....	per lb.....	.17	.17	.1575
Solder (½ and ½).....	per lb.....	.3225	.31	.40
Cotton waste, white....	per lb.....	.10@.13½	.10@.13½	.10@.13½
Emery disks, cloth, No. 1, 6-in. dia.....	per 100...	3.10	3.10	3.10
Lard cutting oil.....	per gal...	.65	.65	.65
Machine oil.....	per gal...	.30	.30	.27
Belting, leather, medium.....	off list....	30–10%	30–10%	40–5%
Machine bolts, up to 1x30 in., full kegs....	off list....	50%*	50%*	50%*

*List prices as of April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
*Flint paper.....	$5.40	$5.56	$5.13
*Emery paper.....	10.71	11.90	10.71
†Emery cloth.....	27.84	27.85	27.84
Emery disks, 6 in. dia., No. 1, per 100:			
Paper.....	1.29	1.45	1.32
Cloth.....	3.10	3.55	3.05
Fire clay, per 100 lb. bag.....	1.00	.75	.75
Coke, prompt furnace, per net ton...	Connellsville, 2.25@2.50		
Coke, prompt foundry, per net ton...	Connellsville, 3.25@3.75		
White lead, dry or in oil...	100 lb. kegs....	New York, 13.25	
Red lead, dry.....	100 lb. kegs....	New York, 13.25	
Red lead, in oil.....	100 lb. kegs....	New York, 14.75	

*4½ reams and under. †Less than 2 reams.

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

	Full Kegs or Cases
Machine bolts, square heads and nuts:	
Up to ¾ x 6-in.....	55%
Larger up to 1 x 30-in.....	50%
1¼ and 1½ in. dia.....	35%
Carriage bolts:	
Up to ½ x 6-in.....	55%
Larger sizes.....	50%
Coach and lag screws:	
Up to ½ x 6-in.....	55%
Larger sizes.....	50%
Tap bolts, hexagonal heads.....	40%
Nuts:	
Hot pressed, square and hexagonal, blank or tapped, up to 1-in., incl.....	55%
Cold punched, square and hexagonal, blank or tapped, up to 1-in. incl.....	55%
Semi-finished, hexagonal, tapped, in packages, all sizes.....	40%
Case hardened, hexagonal, tapped, in packages, all sizes.....	30%
Washers: Deduct from list, per 100 lb.....	$3.50*
Rivets, button and cone head:	
Small, including ⅛-in. dia.....	50–10%
Large (base) per 100 lb. net.....	$5.00†

Note—For less than full package quantities on bolts, screws, hot-pressed and cold-punched nuts, add extra of 10 per cent to list.
*Broken keg lots, $1.50 off list. †Broken keg lots, $6.50 net.

Machine Requirements and Industrial Construction

Equipment Wanted

O., Kent—Bd. Trustees Kent State Normal School, W. A. Cluff, chm., will receive bids until Aug. 31 for equipment for manual training department including 12 in. wood turning lathe, drill, bench grinder, etc., power driven.

O., Middletown—Lindner Mfg. Co., A. C. E. Lindner, Gen. Mgr.—machine tools including small lathe, automatic screw machine, air compressor, etc., for proposed new shop.

O., Portsmouth—Vulcan Air-Craft Co., F. L. Williams, Gen. Mgr. (manufacture air planes)—two drill presses, one 24 in. lathe, automatic machine and air compressor.

Ont., Hamilton—The Steel Company of Canada, Hamilton, R. S. McMaster, Pres.—will be in the market for equipment for proposed new plant improvements, estimated to cost between $6,000,000 and $7,000,000.

Opportunities for Future Business

Calif., Inglewood—City, plans municipal airport, incl. hangars, shops, etc., Mine's Field. Estimated cost $300,000.

Calif., Los Angeles—Bastian-Morley Co., La Porte, Ind., manufacturers of water heaters, purchased site and plans construction of a factory.

Conn., Bristol—E. Ingrahan Co., 392 North Main St., having plans prepared for 5 story, 50 x 162 ft. addition on North Main St. Estimated cost $100,000. M. J. Unkelbach, 52 Main St., New Britain, Archt.

Conn., Stratford—Raybestos Co., Railroad Ave., Bridgeport. S. Simpson, Pres., awarded contract for 1 story, 100 x 300 ft., brake lining plant. Estimated cost to exceed $40,000.

Ill., Chicago—Miehle Printing Press Mfg. Co., 14th St. and Damen Ave., awarded contract for 5 story, 263 x 200 ft., factory. Estimated cost, $450,000. Weiss and Niestadt, Monadnock Bldg., archts.

Ill., Chicago—Victor Manufacturing and Gasket Co., 5750 West Roosevelt Rd. manufacturers of metallic gaskets, having plans prepared for a 4 story addition to present 3 story plant, 100 x 160 ft. at Fillmore and Menard Ave. Estimated cost $150,000. Frank D. Chase Inc., 720 North Michigan Ave., archt.

Ill., Chicago—Wilson Steel Products Co., West 49th St. and Western Ave., manufacturers of wire products, wire nails, etc., had plans prepared for 1 story, 93 x 100 ft. factory. Estimated cost $18,000. F. A. Fielder, 118 East 26th St., Archt.

Iowa, Des Moines—Des Moines Casket Co., J. J. Sloan, Pres., 405 South West 8th St., awarded contract for 2 story, 100 x 145 ft., factory on Indiana Ave. and Maine St.

Mass., Cambridge—The Crane Co., 799 Boylston St., Boston, plans the construction of a manufacturing and storage building on Vassar St., here. Estimated cost to exceed $40,000.

Mass., Everett (Boston P. O.)—G. B. Torngren, 712 Broadway, awarded contract for factory on Garden St. Estimated cost $40,000. Noted June 7.

Mass., Lawrence—Champion International Co., Canal St., awarded contract for manufacturing unit. Estimated cost $140,000. Private plans.

Mass., North Attleboro—Jewelers Cooperative Refining Co., Chestnut St., awarded contract for a factory at Chestnut St. Estimated cost $40,000.

Mass., South Walpole—Bird Machine Co., South Walpole, awarded contract for an addition to plant.

Minn., Duluth—Diamond Calk Horseshoe Co., soon takes bids for construction of a factory at 46th St. and Grand Ave. Estimated cost. $40,000.

Minn., Duluth—Minnesota Power & Light Co., 30 West Superior St., awarded contract for 75 x 110 ft., shops for repair of electric machinery. $80,000.

Minn., Minneapolis—Midwest Heat Regulator Co., A. L. Larson, Mgr., plans construction of a 3 story 39 x 45 ft., factory. Private plans.

Minn., St. Cloud—International Harvester Co. of America, W. D. Price, Const. Supt., 606 South Michigan Ave., Chicago, Ill., awarded contract for 2 story, warehouse and salesroom. Estimated cost $137,600. Noted Aug. 2.

Mo., St. Louis—Century Electric Co., E. S. Pillsburg, Pres., 1806 Pine St., will build with own forces and separate contracts, 1 story, 242 x 262 ft. foundry on 3937 Market St. Estimated cost $200,000. Noted Apr. 19.

N. J., East Orange—Scher & Albert, Inc., (R. Albert), 9 Clinton St., Newark, having plans prepared for 1 and 2 story, 60 x 110 ft., work shops, etc., on Harrison St. Estimated cost $65,000. F. J. Hasselman, 34 Prospect St., East Orange, Archt.

N. J., Hackensack—H. V. Keenan, 29 State St., had plans prepared and takes bids about Oct. 1, for a 5 story garage on State St. Estimated cost $200,000. J. L. & L. Hillack, 173 Main St., Archt.

N. J., Jersey City—H. Burstyn and A. Heftler, 209 30th St., Woodcliff, is having preliminary plans prepared for a garage on Academy St., here. Estimated cost $500,000.

N. Y., Brooklyn—Hoffman Improvement Co., S. Cohn, Pres., 44 Court St., plans the construction of a 1 story, 100 x 131 ft. garage at Neptune Ave. and Boardwalk. Estimated cost $40,000. B. A. Glassman, 44 Court St., Archt.

N. Y., Brooklyn—T. Rossa, 421 Rochester Ave., plans the construction of a 1 story, 99 x 100 ft. garage at Rochester and East New York Aves. Estimated cost $40,000. B. Driesler Jr., 153 Remsen St., Archt.

N. Y., Brooklyn—A. M. Schaedle, c/o S. F. Oppenheim Inc., 156 East 42nd St., New York, Archt., plans the construction of a 1 story, 70 x 193 ft. garage at Manhattan and Devoe Sts. Estimated cost $45,000.

N. Y., New York—Arnold Constr. Corp., 261 Broadway, A. Bashein, Pres., having plans prepared 1 story, 107 x 112 ft., service garage, Mott Ave. and 140th St. Estimated cost $40,000. Moore & Landsiedel, 4509 Willis Ave., Archts.

N. Y., New York—L. Held & Sons, Inc., 810 East 168th St., having plans prepared for 1 story, 57 x 203 ft., service garage at Whitelock Ave. and 165th St. Estimated cost $40,000. H. Ginsberg, 222 East 42nd St., Archt.

N. Y., New York—Richbach Realty Corp., 534 East 72nd St., G. H. Richbach, Pres., having plans prepared for 4 story, 93 x 105 ft. service garage, 407 East 61st St. Estimated cost $75,000. A. Shary, 41 Union Sq., Archt.

O., Ashtabula—Aetna Rubber Co., H. J. Happler, vice-pres. and genl. mgr., 815 East 79th St., Cleveland, awarded contract for a factory and machine shop. Estimated cost $125,000.

O., Cleveland—Grabler Mfg. Co., M. C. Rosenfeld, vice-pres., 6565 Broadway, awarded contract for a 35 x 80 ft. addition to factory. Estimated cost $40,000.

O., Cleveland—The McKinney Tool and Mfg. Co., E. W. McKenney, Pres., Roseland Ave. and Arabelle Rd., awarded contract for 60 x 60 ft. factory and 40 x 40 ft. office both 1 story, Roseland Ave. Estimated cost $50,000.

O., Cleveland—National Screw and Mfg. Co., 2440 East 75th St., had plans prepared for 1 story, 65 x 84 ft. cleaner building, 2440 East 75th St. Estimated cost $40,000. Private plans.

O., Cleveland—Otis Steel Co., c/o J. D. Campbell, 3341 Jennings Rd., had plans prepared for 43 x 190 ft. furnace building, and 36 x 40 ft. boiler house, both 1 story, on 3341 Clark Ave. Estimated cost $50,000. Private plans.

O., Cleveland—The U. S. Aluminum Co., c/o R. C. Wilson, 2210 Harvard Ave., had plans prepared for an office, warehouse and pattern shop. Estimated cost $150,000. Private plans.

Okla., Tulsa—Oklahoma Steel Castings Co., awarded contract for 50 x 50 ft. extension to finishing department.

R. I., Cranston—Kesterman Bros., 150 Chestnut St., Providence, had plans prepared for jewelry factory on Gladstone St. Estimated cost $40,000 or more. Architect not selected.

Tenn., Memphis—Shelby County Comrs., Memphis, Tenn., awarded contract for workhouse including 75 x 260 ft. machine shop at Mullins Station. Estimated total cost $450,000.

Tex., Amarillo—City, c/o J. D. Bartlett, Mgr., plans an election Sept. 8, to vote on $100,000 bonds for construction of an airport, including 80 x 100 hangar, machine shop, etc. H. B. Jones, Engr. Noted Aug. 2.

Tex., Flatonia—Flatonia Crate and Box Factory, c/o C. A. Wheeler, plans construction of crate box factory, including sawmill with all equipment to be electrically-operated. Estimated cost $40,000. Private plans.

Tex., Houston—Parkersburg Rig and Steel Co., Parkersburg, Va., manufacturers of oil well equipment, plans construction of a plant here.

Wash., Seattle—W. E. Grimshaw, c/o H. Bittman, Securities Bldg., Archt. plans the construction of a 6 story, 60 x 108 ft. garage at 1915 3rd Ave. Estimated cost $150,000.

Wis., Milwaukee—Dept. of Public Works, awarded contract for construction of a 2 story, 100 x 140 ft., repair shop for Fire Dept. Estimated cost $94,000.

Wis., Milwaukee—First Wisconsin Natl. Bank, Milwaukee, soon lets contract for 6 story, 100 x 120 ft., garage and store at East Water and Mason Sts. M. Tullgren & Sons Co., 9 Waverly Pl., Milwaukee, Archt.

Wis., Oshkosh—The Wisconsin Parts Co., manufacturers of automobile axles and gears, etc., W. F. Rockwell, Pres. and Genl. Mgr., Forest Ave. and High St., has work underway on office building and addition to shop.

Ont., Hamilton—The Steel Company of Canada, Hamilton, R. S. McMaster, Pres., plans to expend between $6,000,000 and $7,000,000 on plant improvements, beginning 1929 and extending over a period of 2 years. Plans include replacing present 14 in. and 10 in. rolling mills with complete modern 12 in. and 10 in. equipment, extending and improving the blooming mill, soaking pits and water supply, build immense new ore and coal loading docks and equip with modern equipment. Company engineers in charge.

Ont., Sudbury—International Nickel Co., 67 Wall St., New York City, has work under way on the construction of a new smelter, 5,000 tons daily capacity; also 4,500 ton concentrator here. The plants are being built to take care of the coming into production of the Frood mine. Estimated cost between $7,000,000 and $9,000,000.

Ont., Oakville—General Metals Devices, Ltd., Kerr St. soon awards contract for 1 story 60 x 300 ft. factory. Estimated cost, $50,000. R. Card, 142 Chester St., Toronto, archt.